USE OF THE WORLD MODEL FOR POLICY ANALYSIS: EDUCATION AND LABOR POLICY IN THE MIDEAST

by

Barry Hughes, Meshesha Biru, Aminu Hussein and Yvonne Williams

Political Science Department and
Systems Research Center,
Case Western Reserve University

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DEPARTMENT OF STATE

February 6, 1980

Mr. Harry Schreckengost
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Edward N. Lundstrom
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This paper reports on the development and use of an educational component of the World Integrated Model (WIM II) developed at Case Western Reserve University. That model, the second generation Mesarovic-Pestel World Model, already incorporates submodels representing economic, demographic, agricultural, energy, raw materials, and investment goods systems and their interrelationships on a global basis. The model represents the world as 10 basic regional groupings, ~~shown in Figure 1.~~ The major components of the model and their interrelationships to each other can be seen in Figure 2. Each region can be further subdivided into as many as 7 subregions or nations for policy analysis. For detailed descriptions of the WIM II system, see other project reports (Hughes, 1976; Dayal, 1977). Here we will describe the structure only of the new education/labor submodel. Will be described in this Paper.

1. The Literature on Education and Economic Development

It is obvious that education contributes to the economic development of a country. Thus a country with a plan for economic development needs to educate its people accordingly. Many less developed countries waste valuable time and money by over-educating in some fields and under-educating in other fields. One of the purposes of this project was to build a model which could synchronize education with the economic sector in a given country or region, suggesting how to avoid repeating mistakes of over-educating or under-educating.

Figure 1

Regionalization of the World System

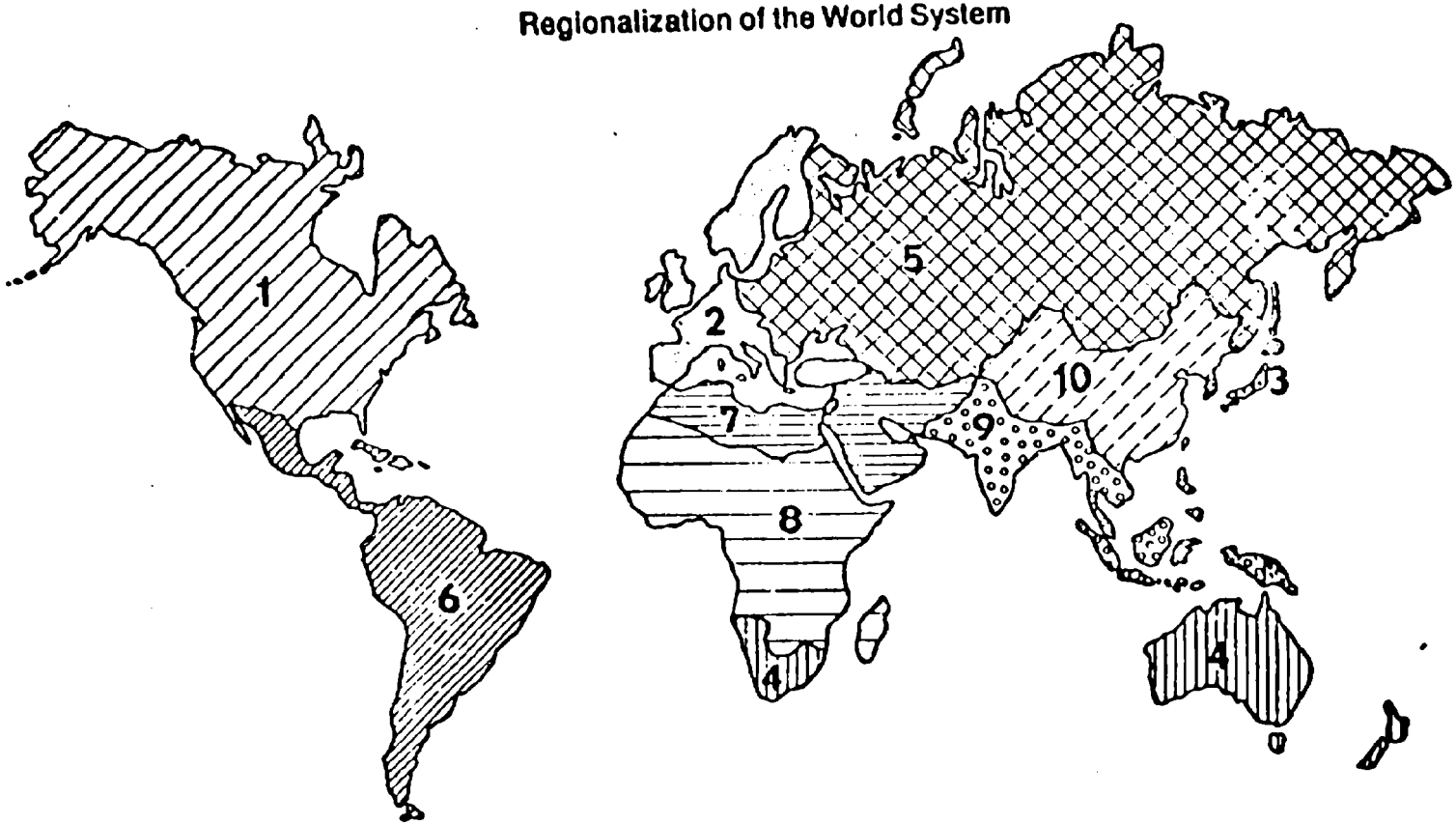
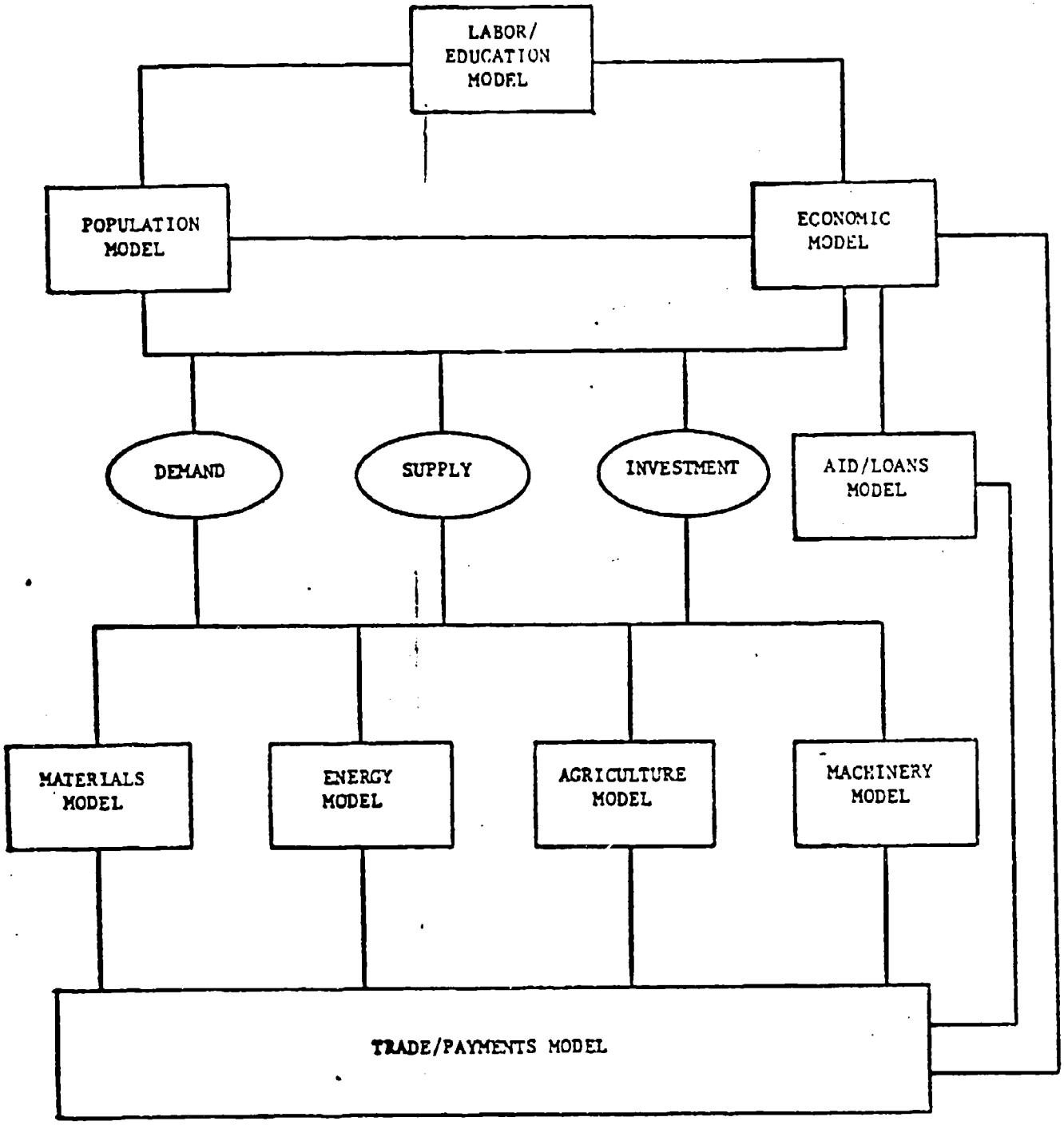


Figure 2: Overall Block Diagram of WIM II



Why is it necessary to be concerned about education? A growing economy will demand a changing labor force; its makeup will vary with the demands of a dynamic economy. Since at the present time it appears that all countries, industrialized and underdeveloped alike, are striving for some measure of economic growth, it would be well to attend to the possibility that some educational planning might accelerate that growth. At any rate, a proper educational mix is necessary in the labor force to supply the needs of any economy. If we can project the growth rate of a given sector of the economy, then we can estimate how many workers will be needed in that sector at a given point in time. Knowing the educational requirements of a given economic sector, it will be possible to determine at what level or levels any group of workers should be educated. Less developed societies are by definition more labor intensive, thus requiring less of an educational mix. But as the economy grows, the labor requirements will change, as well as the educational needs. This computer-based sub-model should be able to tell us how much of a change in the educational mix is required at a designated level of development as indicated by the GNP.

Franklin Roosevelt, Jr., has said of the impoverished U.S. Appalachian region that:

> The problem behind Appalachia's unemployment problem is not simply that the resource potential is underdeveloped and that it lacks an industrial complex which might be diversified or amplified to make use of the unemployed. The problem is even more basic and more grave: It is that in Appalachia there exists no standard...labor force, with ready aptitudes or a diversity of basic skills; there is a deficit in the

> educational resources needed to raise even the level of functional literacy--let alone the level of vocational ability... (Roosevelt, 1965).

That statement could be broadly applied to underdeveloped areas everywhere. The attempt herein is to measure to what extent education contributes to the economic development of nations, with a view to establishing a definitive methodology.

The determinants used are primarily based on economic considerations, rather than those of a socio-political nature. Such socio-political factors surely ought to be evaluated in any consideration of educational goals. It is obvious, however, that viable methods of quantitative analysis of these elements do not now exist. (Harbison and Myers, 1964). The attempt to develop an educational model follows the method established by Mesarovic and Pestel in the development of the Integrated World System Model. (Mesarovic and Pestel, 1974).

Many studies have been made and numerous conferences held on the problems involved in and the need for regional cooperation, and a number of them have addressed themselves to the importance of education as a factor in economic development. Frequently, they have concentrated their analyses on higher education as the prime necessity in any cooperative scheme. (Engels, 1975; OECD, 1970). These and other studies generally lack a quantitative approach to the problem.

Exceptions to the above are the studies done by Harbison and Myers (Harbison and Myers, 1964, 1965), and a number of studies by the OECD which concentrate primarily on the European countries. Harbison has

called attention to one of these latter studies which involves work done by Ingvar Svennilson as the principal investigator, in which school enrollment ratios in various age groups for some 22 countries are correlated with GNP per capita. The result was a positive relationship between the two variables. In the present work, a similar approach has been taken by correlating the percentage of persons at four different educational levels with GNP per capita for a total economy, both by region and by sector.

Grant Harman (Harman, 1974) sees the problems of educational needs as being primarily political ones, within a policy-making context, while Benson, et al., (Benson, Ritzen and Blumenthal, 1974) have engaged in some quantitative analyses of the inputs and outputs of the educational system, enlisting an educational production function, and some cost-benefit analysis. No attempt has been made to develop a functional model.

The OECD report on Regional Cooperation in Asia (OECD, 1970) is an exception to the generality stated above that such studies concentrated on Europe. There is, however, no quantitative methodological approach documented in this report, either for economic or other kinds of cooperation.

Harbison and Myers (op. cit., 1964) have engaged in the most thorough analysis of the economic benefits of education which we have seen to date. They have indicated that the primary approaches in attempting to assess human resource development, or the contribution of education to economic growth, have been: (1) the determination of the

relationship between expenditures on education and capital growth; (2) a residual approach in calculating the per cent of education's contribution to GNP; (3) calculation of the rate of return on educational expenditure; (4) cross-national correlations of GNP and school enrollment ratios. Their appraoch is best described in their own words, as follows:

> ...we have used a composite index of human resource development to rank a representative list of seventy-five countries and to group them into four levels of human resource development. Statistical mid-points (means) for each of the indicators for each of the levels have been computed, and these show clear differences between countries in the less advanced levels. There are significant correlation coefficients between the composite index and GNP per capita in United States dollars, as well as among a number of the other indicators of human resource development and those which measure economic development. (Harbison and Myers, 1974, p. 44).

The results of Harbison and Myers' work do not establish any causal relationships. They used only two indicators for the level of economic development--GNP per capita and per cent of population working in the agricultural sector. Our effort utilizes the following economic indicators: (1) GNP per capita; (2) value added to labor ratio; (3) labor distribution by sector; (4) educational expenditures; (5) labor supply. Some specific education indicators also used are: (1) population; (2) labor educational make-up; (3) enrollment ratios; (4) educational costs. How these variables fit into the model structure will be explained subsequently.

Vaizey, like Svennilson, has established a positive relationship between school enrollment ratios and GNP per capita. (Vaizey, 1967). He has based his ratios on age groups currently enrolled rather than

overall percentages at each level of education. This is his attempt to measure the phenomenon which he notes in an earlier work (Vaizey, 1962) that it is worth spending money on education because it assists the economy. Again, we see the concept of increased education yielding increased individual earnings.

A 1966 report prepared by the ILO is entirely devoted to labor mobility in Western Europe--geographical, occupational and inter-sectoral--without any notice being given to the educational variables which may partially influence or be influenced by such movement. (U.S. Dept. of Labor, 1966). We found labor immigration to be an important variable in the final determination of the labor educational supply.

Ahamad and Blaug have collected a number of useful case studies of various manpower forecasts and projections which utilize a variety of methods. (Ahamad and Blaug, 1973). In the case of Sweden, for instance, a combination of questionnaires, survey techniques and historical statistics have been used to forecast data on the number of engineers needed in that country. (Gannicott, 1973). With respect to Nigeria, Hinchliffe has reviewed several separate reports, produced primarily by Nigeria's National Manpower Board, to give an overall view of that country's manpower requirements. (Hinchliffe, 1973). Each of the studies in Ahamad and Blaug is quantitatively based and apparently thoroughly researched but nevertheless somewhat limited from the point of view of these writers in that they concentrate on the projected needs of one profession within a country or attempt to forecast for all

occupational manpower needs for a specific country. While a limited number of cross-national comparisons are made, there is no attempt at a unified, global or regional projection.

We are also aware of Jay Forrester's use of an educational component in his National Socio-Economic Model, as reported in the U.S. Congress (U.S. Congress, 1975; Forrester, 1975), and of the work done by the Bariloche Foundation of Argentina, including an education model. Information on these efforts and the structure of their education submodels is currently scanty.

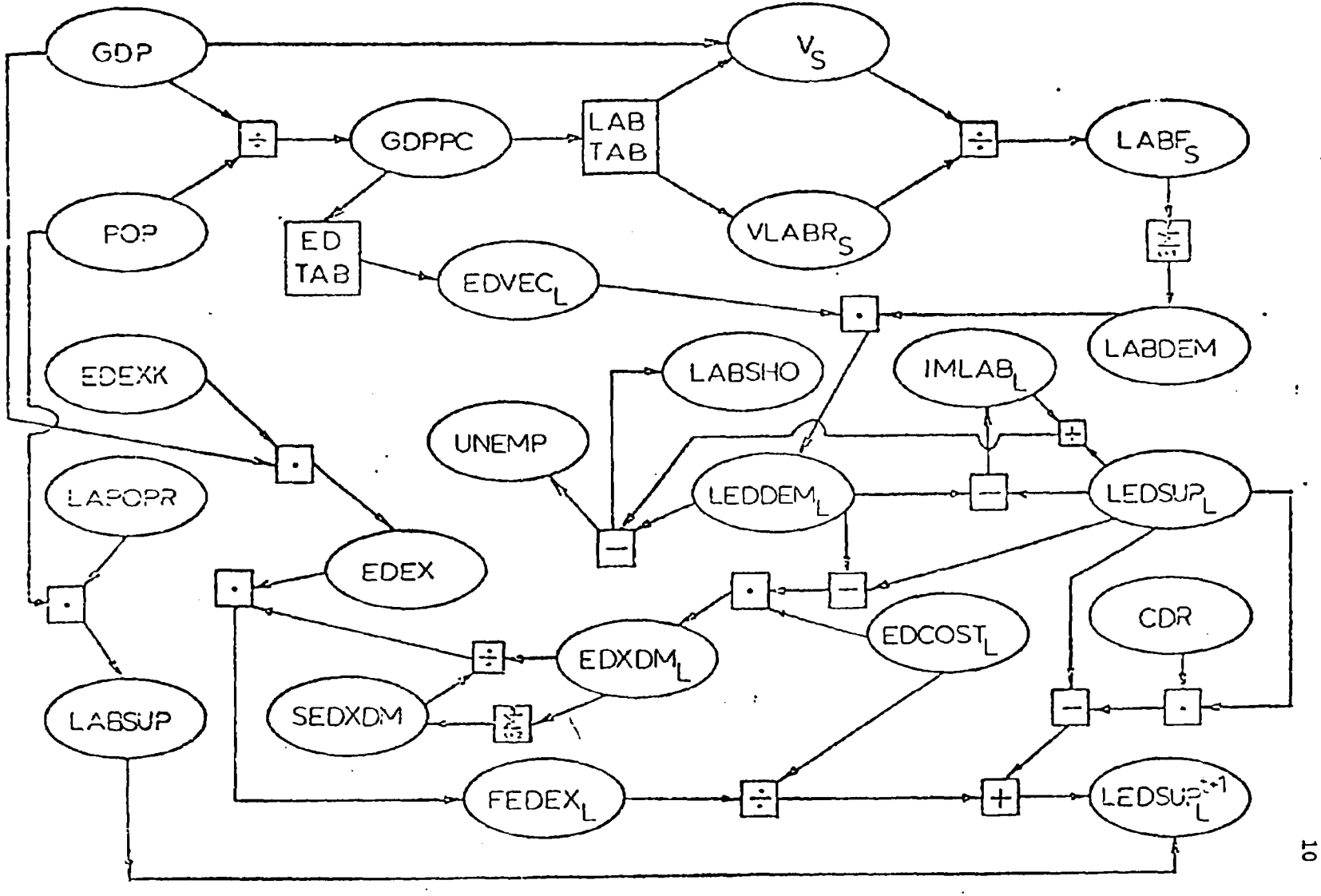
In conclusion, there has been considerable need for a model of educational processes on a cross-national basis, linking the expeditures available for education and training to the size of the economy and government policies, and linking the availability of educated labor back to economic growth. That is what we discuss in the next section.

2. Structure of the Education/Labor Submodel

Figure 3 is a simplified flow chart of the education/labor model. The model has a demand and a supply side. On the demand side the labor force is a function of the size and level of economic development of the various regions. Two approaches have been incorporated into the model to represent these relationships. In one case labor demand is represented in each of seven economic sectors (agriculture, extraction, manufacturing, construction, wholesale/retail, transportation/communications and services). Within each sector the relationship between the

Figure 3.

EDUCATION MODEL



Variable Description List for Figure 3

Variables	Definitions
GDP	Gross Domestic Product
V_s	Value added by sector
POP	Population in millions
GDPPC	Gross domestic product per capita
$VLABR_s$	Value added to labor ratio by sector
$LABF_s$	Labor requirements by sector
$EDVEC_1$	Educational vector describing the fraction of the labor force required from each educational category
LABDEM	Labor demand for the entire economy
LABSHO	Labor shortage
UNEMP	Unemployment in millions
$IMLAB_1$	Net immigration of labor by educational category
$LEDDEM_1$	Labor demand by educational category
LEDSUP	Labor supply by educational category
EDEXK	Educational expenditure coefficient, specifying a a portion of governmental expenditures going to education
EDEX	Educational expenditures in billions of 1963 dollars
LAPOPR	Labor to population ratio (labor participation rate)
LABSUP	Labor supply for the total population
$EDCOST_1$	Educational cost by level of education
CDR	Crude death rate
$EDXDM_1$	Educational expenditure demand by level of education
SEDXDM	The sum of educational demand expenditures across levels of education
$FEDEX_1$	Final educational expenditures by level of education

labor requirements for each unit of output and the level of economic development has been studied on a global basis and can be used to project labor requirements for various economies. In the second approach a Cobb-Douglas function is used in an inverted fashion to project labor requirements for the economy as a whole from the size. For the scenarios analyzed later in this report the Cobb-Douglas projection form was used.

Given gross labor requirements, the next section of the education/labor model calculates the requirements for labor in four educational categories: uneducated, primary education, secondary education and university education. These categories correspond quite closely to a division of labor into unskilled, semi-skilled, skilled and professional, respectively. For the purposes of modeling it also makes sense to maintain the educational level divisions because this allows us to more satisfactorily represent the supply side of the model, namely the processes by which individuals in society obtain training and skills. Again, we have examined on a global basis the relationship between level of economic development and educational level requirements within the labor force, using data across a wide spectrum of more and less developed economic systems.

The supply of educated laborers is provided mainly by the educational system of the country and for the most part depends on how much the country is spending on education and the cost of education. Generally, countries with a high GNP per capita spend about 6% of their GNP on education while countries with low GNPs per capita spend in the neighbourhood of 3% of their GNP.

On the supply side of the model we represent the expenditures, public and private, on education within a country or region. The model also represents the cost of educating or training individuals at the various educational attainment levels. Depending then upon the requirements for trained individuals within the labor force and upon decisions made concerning education within the countries or regions, educational expenditures are divided among training programs at the various educational levels. The model keeps track of the labor supply with various levels of education at any given time, and each year it represents the number of deaths at each education level and the number of additional people trained at that level. Table 1 shows data on level of education in each economic sector for selected countries. Data for other countries can be found in Appendix I.

Given a demand and a supply side within the model there is obviously the opportunity to compare the two and to allow for permanent or temporary migration among regions. The model allows immigration to be handled in either of two ways: either to be specified by the model user or to be computed by a supply-demand basis within the model itself.

Given demand and supply of labor by educational category, and after the specification or calculation of international migration, it is obviously also possible to specify the level of labor unemployment or of labor shortages. It is, of course, quite possible for an economy to have both unemployment and labor shortages, because of an improper match between training and educational requirements of the economy and the

Table 1: LEVEL OF EDUCATION DISTRIBUTION BY ECONOMIC SECTOR

Economic Sectors:		I	II	III	IV	V	VI	VII
United States								
Educ. Level	1	----	----	----	----	----	----	----
	2	27682 59.0%	3212 45.0%	62571 34.0%	18216 42.0%	28049 21.0%	14101 30.0%	58115 26.0%
	3	16410 35.0%	2928 41.0%	95448 52.0%	20556 48.0%	77879 59.0%	26115 56.0%	98218 44.0%
	4	2972 6.0%	991 14.0%	25668 14.0%	4244 10.0%	25865 20.0%	6117 13.0%	64705 29.0%
Norway*	1	----	----	----	----	----	----	----
	2	270598 98.7%	8419 92.8%	320590 89.4%	124339 93.3%	133229 71.3%	164991 91.5%	159383 75.4%
	3	2726 .09%	493 5.4%	33056 9.2%	7900 5.9%	50069 26.8%	13742 7.6%	13095 6.2%
	4	495 .18%	160 1.7%	4578 1.3%	997 .7%	3526 1.9%	1548 .9%	38756 18.3%
Yugoslavia*	1	----	----	----	----	----	----	----
	2	50006 68.2%	26837 69.8%	324276 81.3%	38222 58.9%	60220 69.7%	43635 65.5%	123281 27.7%
	3	15133 20.6%	8514 22.1%	58485 14.7%	18651 28.8%	20534 23.8%	17982 27.0%	105064 23.6%
	4	8221 11.2%	3096 8.1%	16141 4.0%	7963 12.3%	5598 6.5%	4970 7.5%	215731 48.6%
Japan	1	----	----	----	----	----	----	----
	2	119942 83.2%	4059 76.2%	64777 68.2%	20593 76.2%	42383 55.3%	13350 54.8%	28318 43.6%
	3	22712 15.8%	1044 19.6%	24291 25.6%	5199 19.2%	28353 37.0%	9193 37.7%	2365 36.3%
	4	2701 2.0%	225 4.2%	5871 6.2%	1236 4.6%	5915 7.7%	1815 7.5%	13140 20.1%

Source: OECD. Statistics of the Occupational and Education Structure of the Labor Force in 53 Countries. Paris, 1969.

* Labor force figures are absolute for countries with asterisk; without asterisk, labor force figures are in thousands.

availability of skills. We will, in fact, see this in the scenarios presented here.

There are many aspects of this educational model which we have not yet discussed. For instance, in the immigration subsection of the model it is also possible to represent restrictions on the emigration or immigration of labor for any country or region by labor category. The model also represents the repatriation of a portion of laborer income to the home country.

In addition the entire education model is embedded into the world integrated model (WIM II) system. This provides still additional capabilities. For instance, WIM II allows very flexible foreign assistance programs. As noted before WIM II also includes representation of the energy systems, agricultural systems, and full economies of 10 major world regions.

3. Details of the Model and Data

This section of the proposal presents further detail concerning the structure of the education/labor model. Those who are not interested in additional detail can go directly to the next section without loss of continuity. What we shall do here is to present the equations of the education/labor model and present some of the data underlying the model.

We can begin with the demand side of the model. There are two approaches to projecting labor demand in this model. The first approach computes labor demand by economic sector (LABDES) as a function of the

value added in each sector (V) divided by a value added to labor ratio for the sector (VLABR). This form can be seen in equation 1. The value addeds are

(1) $LABDES_S = V_S/VLABR_S$

where

$VLABR_S = F\ (GNP/POP)$

provided to the labor/education model by the economic model. The economic model represents the economy in seven basic sectors: agriculture, extraction, manufacturing, construction, commerce, transportation/communications, and services.

A study was made across a broad range of countries of the labor force in various economic sectors. The primary source of data for this analysis was the Yearbook of Labor Statistics from the International Labor Organization. In the analysis we studied the amount of output per worker in each of these sectors as a function of the level of development of the economy as represented by the gross national product per capita. (See Table 2 for the data on value added per laborer.) For example, Figure 4 shows the value added per member of the labor force as a function of GNP per capita in 26 countries. The data on sectorial value addeds came from the United Nations' Yearbook of National Account Statistics. These relationships for all seven sectors have been represented by table functions, as shown in Table 3. It is thus possible to specify the GNP per capita of the region and to retrieve the normal pattern of labor output for each of the seven sectors - that is, the

Table 2

Value added per laborer
in U.S. $

Sector: / Country	I	II	III	IV	V	VI	VII
Ecuador	574.0	10000.0	818.0	879.0	1197.0	1474.0	1272.0
Egypt	285.0	3194.0	1312.0	964.0	1137.0	988.0	930.0
India	147.0	650.0	263.0	817.0	484.0	480.0	89.0
Israel	2185.0	15459.0	3083.0	4959.0	3782.0	3240.0	3569.0
Japan	923.0	11414.0	2804.0	2176.0	1760.0	5378.0	3250.0
Norway	2655.0	28660.0	4970.0	4846.0	6577.0	5128.0	6052.0
Peru	430.0	4933.0	484.0	1593.0	2018.0	1560.0	1060.0
Phillipines	425.0	6680.0	1242.0	1000.0	1198.0	842.0	1580.0
Argentina	1820.0	9574.0	2576.0	1670.0	2820.0	2478.0	1805.0
Thailand	97.0	1776.0	783.0	2226.0	802.0	3445.0	560.0
Yugoslavia	397.1	1564.2	2046.8	2542.8	5209.6	868.6	51.2
Hungary	969.0	1364.9	1630.1	2333.1	2620.1	860.2	105.2
Uruguay	1220.6	17875.0	2265.6	1781.2	3014.-	2510.1	2028.2
Panama	822.1	18222.2	2300.7	1942.4	1539.7	1626.0	3942.3
Syria	373.3	8709.9	1131.2	839.4	2344.6	1880.3	773.9
Zambia	837.1	18167.3	5747.5	1708.4	5137.4	1575.8	678.5
U.S.A.	5060.7	35603.6	8685.5	9992.3	7421.7	7637.9	13626.7
U.S.S.R.	1697.2	11215.8	2842.5	3022.2	2257.9	1569.3	587.8
Poland	894.4	9369.4	1958.5	2273.0	2565.0	1793.7	201.2
Sweden	2880.0	15969.0	3763.0	7123.0	5100.0	5405.0	9655.0
France	1837.0	7018.0	5046.0	4459.0	3513.0	3520.0	8411.0
Austria	.6575.0	6385.0	3453.0	3321.0	5228.0	2955.0	4358.0
Canada	3484.0	29621.0	6826.0	7531.0	4968.0	7338.0	11487.0
U.K.	4483.0	5981.0	3283.0	3996.0	3571.0	3662.0	5334.0
Ireland	1620.0	13067.0	2741.0	2495.0	2061.0	2084.0	46?2.0
Netherlands	3431.0	5707.0	4217.0	3891.0	3864.0	4944.0	7349.0

Source: ILO Yearbook of Labor Statistics and UN National Account Statistics.

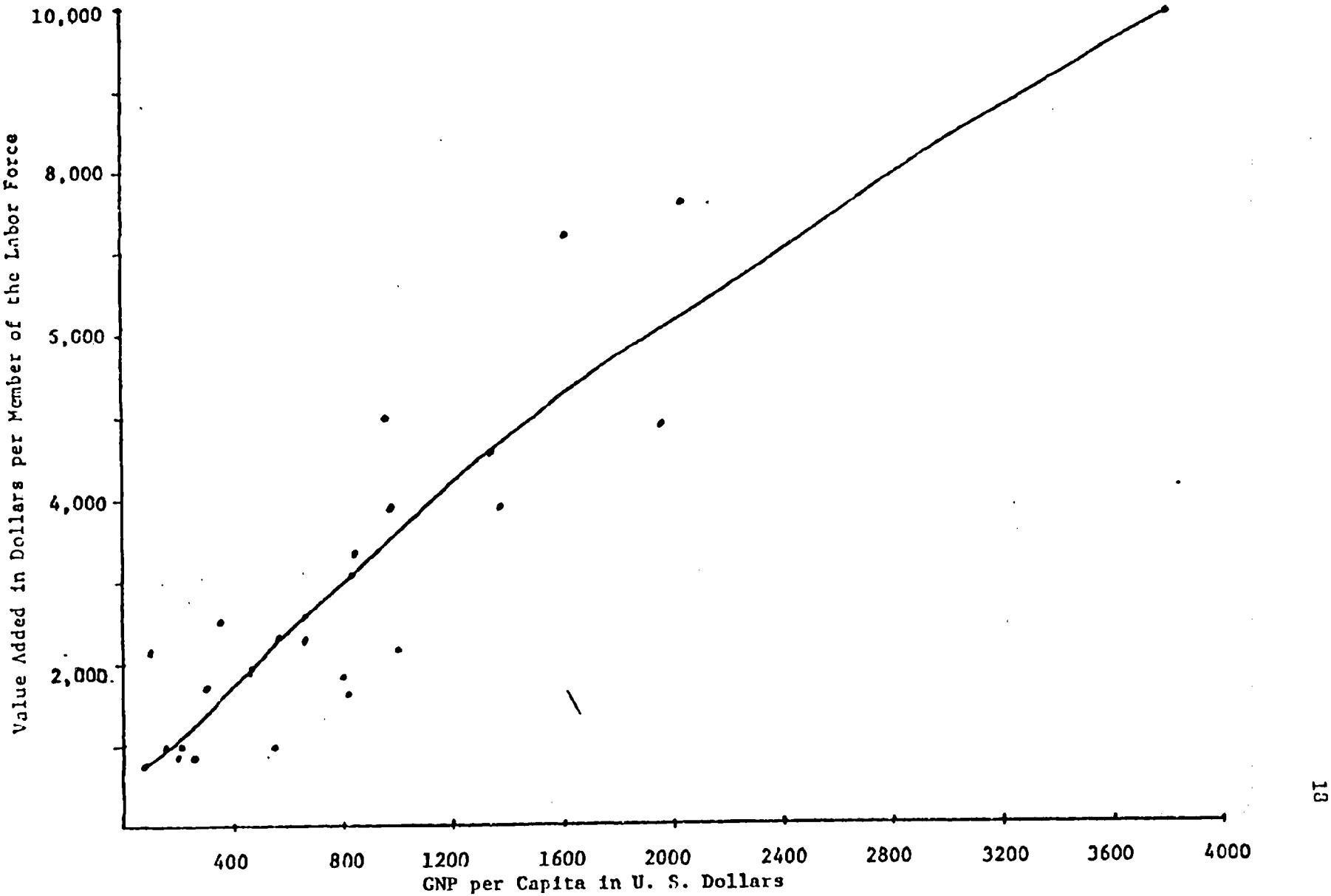


Figure 4: Value Added to Labor Ratio in the Construction Sector of 26 Countries

Table 3

Value added per laborer at different GDP/C values.

LABTAB

V/L by sector \ GDP/C	0	100	200	500	1000	3000
1 (Agriculture)	0	210	375	860	1800	4800
2 (Mining)	0	1700	3500	8000	14400	33000
3 (Manufacturing)	0	350	575	1550	2850	6225
4 (Construction)	0	750	1100	2100	3600	8300
5 (Commerce)	0	900	1200	2550	4200	7250
6 (Transport & Communication)	0	800	1100	1750	2900	6900
7 (Services)	0	520	900	2200	4120	11280

value added to labor ratio ($VLABR_s$). These ratios are, of course, adjusted to represent regional differences found in the specific data for each country or region. Having this information we can then compute the labor demand by sector ($LABDES_s$). Equation 2 represents the summation of these sectorial labor requirements to get the total labor demand (LABDEM) for a country or region.

$$(2) \qquad LABDEM = \sum^{S} LABDES_s$$

The second approach to the projection of labor demand uses the Cobb-Douglas production function in inverted fashion. Equation 3 represents the computation of labor demand as a function of gross national product (Y),

$$(3) \qquad LABDEM = (Y/aK^{\alpha})^{1/\beta}$$

capital (k), and the parameters of the Cobb-Douglas function.

Whichever approach is used for the computation of total labor requirements of the economy, the next step is to specify those requirements by level of education or training. Equation 4 shows the labor requirements by educational level (LEDDEM) as a function of total

$$(4) \qquad LEDDEM_L = LABDEM * EDVEC_L$$

where

$$EDVEC_L = F\ (GNP/POP)$$

labor demand and an educational vector (EDVEC). The educational vector

represents the proportion of the labor requirements which should be drawn on in normal circumstances from each of the four levels of education. This is obtained as a function of the level of development in the economy, as represented by the gross national product per capita. Again, an extensive cross national study was undertaken in order to determine the relationship between level of economic development and educational levels in the labor force. This study drew upon data presented in an OECD study of 53 countries. (OECD, 1969). Figure 5 shows as an example the percentage of the agricultural labor force with various educational levels across a spectrum of countries. This allows us to project, economic sector by economic sector, the educational background desired in the labor force.

Unfortunately, in the OECD study of 53 countries, only 19 countries provided data in the form that we need for our analysis. We found it difficult to get representative countries for each of the 10 world regions. For example, of the 43 countries in the Main Africa region we can only find the educational make-up of the labor force of one country, Zambia. In the case of some countries from Eastern Europe data on the educational make-up of the labor force is furnished; however, the sectorization of the economy is different enough for us to exclude them. Table 4 shows the total labor force for each of the 19 countries by educational level.

In constructing the table function relating economic development level to education of the labor force, we used four educational levels: level one is no education; level two is primary education; level three is

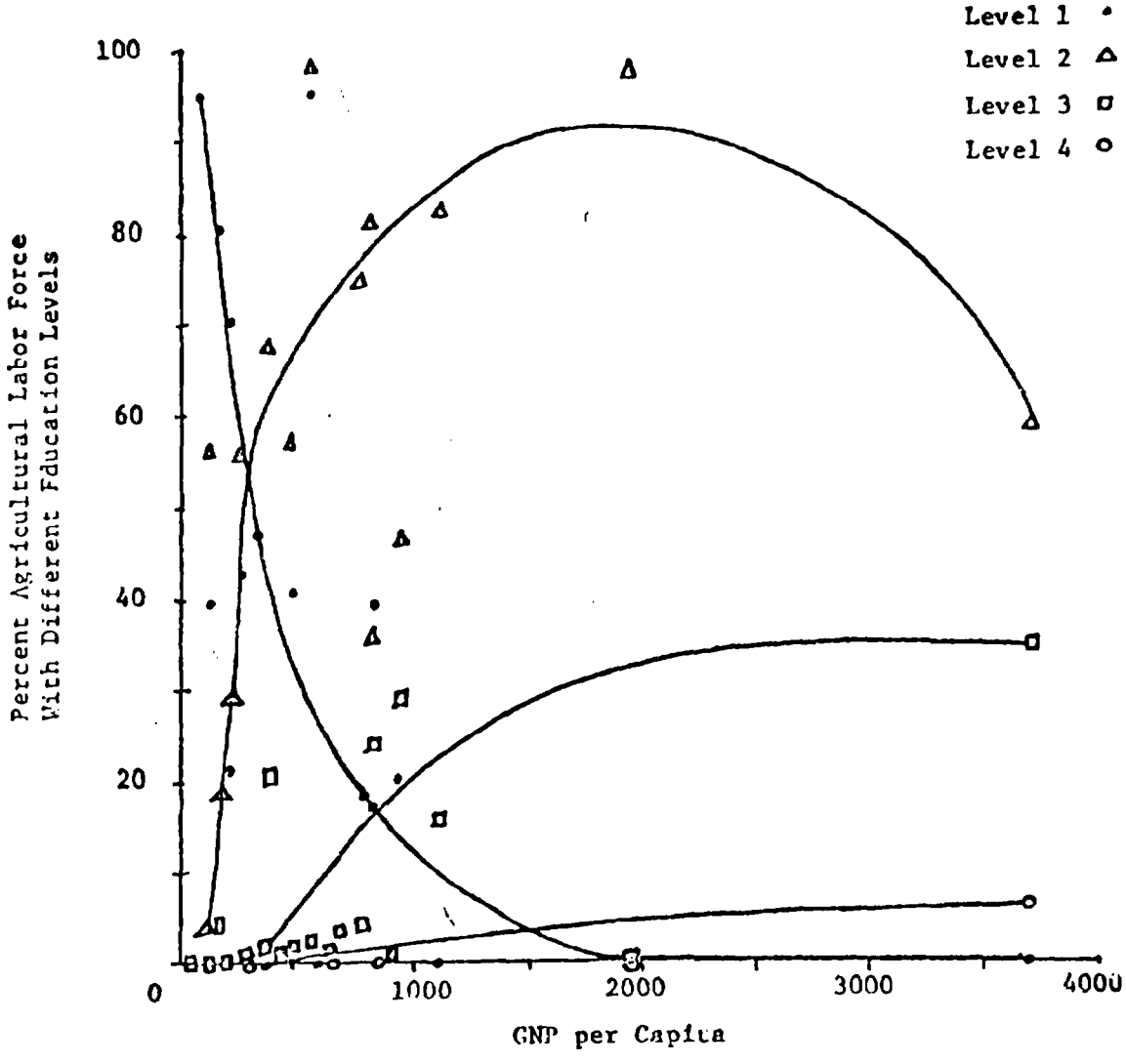


Figure 5. Percentage of the Labor Force with Various Education Levels - Agriculture

Table 4: Labor Force by Educational Level

Region	Country	Education Levels 1	2	3	4	Total
1	U.S.A.		21,194,600	33,755,400	13,056,200	68,006,200
2	Norway		1,181,549	121,081	50,060	1,352,690
3	Japan		29,342,200	11,444,900	3,090,300	43,877,400
4	Israel	63,290	363,330	225,315	60,965	712,900
5	Poland		4,788,910	2,037,969	310,386	7,137,265
	Yugoslavia		666,477	244,363	261,720	1,172,560
	U.S.S.R.	22,573,000	31,798,000	3,825,800	3,156,000	61,352,800
	Hungary		4,157,272	424,415	164,062	4,745,749
6	Uruguay	86,900	681,500	161,900	65,200	74,408,374
	Ecuador	430,428	859,281	115,321	37,560	1,442,590
	Panama	69,855	167,052	51,761	10,718	299,386
	Peru	938,051	1,643,069	348,037	93,502	3,022,659
	Argentina	744,135	6,025,790	432,590	324,080	7,526,595
7	Egypt	4,798,849	2,109,318	318,527	124,135	7,350,829
	Syria	1,006,327	407,501	36,232	7,834	1,457,894
8	Zambia	228,625	18,691	18,263	3,864	269,443
9	Thailand	474,700	718,700	70,400	5,500	1,269,300
	Philippines	1,589,769	5,904,080	1,318,341	587,203	9,399,393
	India	169,633,000	13,750,000	5,398,000	1,902,000	190,713,000
		171,727,469	20,372,780	6,786,741	2,494,703	201,381,693

Source: OECD, Statistics of the Occupational and Education Structure of Labor Force in 53 Countries, Paris, 1969.

secondary education; and level four is higher education. People who are catagorized into primary level are those who finished any of grades one through seven. The secondary catagory includes those who have completed any of grades 8 through 12. The higher education catagory includes those who have completed any college from the first year through post graduate years. Table 5 shows the actual table function.

Turning to the supply side of the labor/education model we can see in equation 5 the representation of total labor supply (LABSUP), for each

(5) LABSUP = LAPOPR * POP

of our countries and regions, as a function of the labor participation rate (LAPOPR) and the population (POP). Given the total labor supply we can move further to projection of the labor supply by educational categories. The procedure here is to represent the educational expenditures of a country or region, the number of people trained and added to the labor force as a result of those educational expenditures, and deaths among members of the labor force. Equation 6 represents total educational expenditures of a country or region (EDEXT) as a function of

(6) EDEXT = EDEXK * G

an educational expenditure coefficient (EDEXK) and total governmental expenditures (G). Data concerning the level of educational expenditures and enrollments in countries throughout the world were obtained from the

Table 5

EDUCATION TABLE

% of labor force in
different levels of education
at different GNP/C values.

Educ. Level		0	100	500	1000	2000	3000
Level 1	all sectors	100.0%	80.0%	13.5%	7.5%	5.0%	4.5%
Level 2		0.0%	10.0%	53.0%	75.0%	92.5%	57.0%
Level 3		0.0%	2.0%	11.5%	21.0%	37.0%	41.0%
Level 4		0.0%	.5%	2.0%	5.0%	10.0%	15.0%

United Nations Statistical Yearbook and from World Military and Social Expenditures 1976. Table 6 shows the educational expenditures in 1973 of a variety of Arab Region countries as well as other educational data for those countries, since we will focus on them in the next section. Table 7 shows educational expenditures as a percentage of GNP for each of the 10 world model regions.

Having total educational expenditures these expenditures are split among level of education primarily according to the demand for trained individuals by the economy. Thus, equation 7 shows educational expenditures

$$(7) \qquad EDEX_L = F\ (LEDDEM^{t-1} - LEDSUP^{t-1},\ EDEXT)$$

by level (EDEX) as a function of the difference between labor/education demand (LEDDEM) and labor/education supply (LEDSUP), bounded of course by total educational expenditures (EDEXT).

Equation 8 represents the conversion of educational expenditures to newly trained individuals (LEDNEW). The number of individuals trained

$$(8) \qquad LEDNEW_L = EDEX_L / EDCOST_L$$

with the given level of educational expenditures does of course vary according to the educational cost (EDCOST) in different countries and regions. Thus, an extensive study was also done of differential costs of education throughout the world. Table 8 shows some of the data underlying that study: total education expenditures at different levels

Table 6: Education Data for the Arab Region (1973)

	Public Expenditures on Education million US $	Public Education Expenditures Per Capita US $	School Age Population in School %
Egypt	393	11	42
Iraq	277	27	42
Jordan	22	9	60
Kuwait	210	239	60
Lebanon	74	24	48
Libya	402	186	60
Saudi Arabia	435	56	27
Syria	95	14	57
Yemen, Arab Republic	6	1	9
Yemen, People's Dem. Rep.	11	7	35

Source: World Military and Social Expenditures, 1976.

Table 7

Total expenditure on education as percentage of GNP--by region.

Region	Expenditure as % of GNP
I (North America)	7.6
II (Western Europe)	5.6
III (Japan)	4.1
IV (rest of developed world)	5.4
V (Eastern Europe)	5.4
VI (Latin America)	4.5
VII (North Africa and the Middle East)	4.7
VIII (Middle Africa)	5.5*
IX (South and Southeast Asia)	2.9

* This value is not a weighted average for Region VIII because we were not able to find data on other countries that belong to this region. This value is Zambia's educational expenditure as % of GDP.

Source: United Nations Statistical Yearbook, 1973.

Table 8: Current Expenditures on Education

	No. of Pupils Pre-school + 2nd Level	Total Cost for 2nd Level	No. of Pupils at the Third Level	Total Cost Pre + 2nd + 3rd Level Per Pupil	No. of Pupils at the 4th Level	Total Cost Pre + 2nd + 3rd + 4th Level Per Pupil
	3,155,907	4578.00	2,603,921	9156.00	652,176	20850
	34,180,000	6100.50		10458.00		18770.40
	661,947	133.60	822,316	372.00	73,467	993.20
any	7,890,683	1326.80	4,815,556	5473.10	662,232	14375.90
	7,130,549	1081.50	4,742,060	5329.80	739,000	10635.00
	6,331,821	1630.20	4,221,643	5151.90	615,566	17556.30
l	530,303	1409.60	229,922	3604.10	28,501	8395.30
ands	1,956,605	1817.40	1,330,748	6084.60	247,964	15041.00
	387,995	6484.20	341,672	9729.00	57,914	16940.60
	766,455	7975.80	554,295	12262.80	133,708	22909.60
avia	3,004,117	947.20	770,665	1896.40	301,758	3254.40
	11,538,691	1920.00	8,843,091	4260.00	2007,810	6420.00
	629,655	1787.80	141,981	6400.00	61,555	12874.40
r	1,313,717	3380.80	431,796	4924.80	90,857	15957.20
	5,737,293	5372.00	1,428,459	12482.00	429,646	50574.40
R.	48,147,500	863.20	9,612,900	5015.20	4630,000	7762.80
ina	3,723,946	327.60	1,058,945	1267.60	351,287	2535.60

e countries give the percentage allocation of pre-school + 2nd level + 3rd level together. Therefore the figures
n under total cost pre + 2nd + 3rd level is the average for those levels.

	No. of Pupils Pre-school + 2nd Level	Total Cost for 2nd Level	No. of Pupils at the Third Level	Total Cost Pre + 2nd + 3rd Level Per Pupil	No. of Pupils at the 4th Level	Total Cost Pre + 2nd + 3rd + 4th Level Per Pupil
ıador	1,030,238	124.20	228,539	643.80	43,743	1106.20
ıama	314,910	499.20	98,836	1351.80	8,159	4844.20
·u	2,740,559	230.50	790,025	694.00	138,935	2074.00
ıguay	374,227	636.60	174,300	1558.20	18,650	5147.80
·pt*	4,020,906		1,665,641	800.57	305,653	2153.37
·ia	1,033,229	181.20	408,007	484.20	49,192	
ıbia	729,801		64,910		1,671	
·ia	68,987,000	18.50	8,986,609	334.70	2,009,134	842.30
.lippines	6,926,782	161.40	1,791,176	190.20	651,462	
.ilend	6,232,304	617.40	700,728	1759.40	63,823	3575.10

hese countries give the percentage allocation of pre-school + 2nd level + 3rd level together. Therefore the figures iven under total cost pre + 2nd + 3rd level is the average for those levels.

Source: UNESCO Statistical Yearbook, 1974.

of education and pupils enrolled. Table 9 shows the same data aggregated for the region of the model. Equation 9 shows the procedure by which the labor/education supply is updated every time cycle. Simply,

$$(9) \qquad LEDSUP_L = LEDSUP_L^{t-1} * (1. - CDR_L^{1000}) + LEDNEW_L$$

where

$$\sum_{L}^{L} LEDSUP_L = LABSUP$$

it is a function of the supply in the previous time period minus those who have died (using the crude death rate - CDR) and plus those who are newly trained. Of course, it is necessary throughout the process of equations 6 through 9 to assure that the total labor/education supply is equal to the labor supply computed in equation 5. Data were also gathered on the initial values of labor/education supply (LEDSUP). (Refer back to Table 4.)

We can turn now to the basic equations to represent international labor migration. Migration is handled in one of two ways, or with the combination of the two procedures for different labor categories and/or different regions. The first procedure is to allow specification of labor immigration or emigration exogenously (IMLABE), that is determined by the model user. This is represented in equation 10. The variable computed in that equation is the desired inward or outward migration of

$$(10) \qquad IMLABD_L = IMLABE_L$$

Table 9

Weighted Average Cost of Education

Region	Pre-School and 2nd level		3rd level		4th level	
	cost per pupil per year $U.S.	total cost per pupil $U.S.	cost per pupil per year $U.S.	total cost per pupil $U.S.	cost per pupil per year $U.S.	total cost per pupil $U.S.
1			861	10332	2133	18866
2	292	1752	507	5019	1932	12748
3	320	1920	390	4260	540	6420
4	255	1788	769	6400	1619	12874
5	174	1392	1395	6973	1461	12815
6	47	282	142	1134	1228	6048
7			60	726	291	1890
8	5	35	379	1930	3119	14406
9	12	72	56	352	136	896

Source: Compiled from Table 8.

labor (IMLABD). The reason that this is desired rather than actual migration is that we must, of course, assure a world-wide balance of inward and outward migration. Thus we first specify by region and by level of education the desired migration levels. We shall see in equations below how a world balance is obtained.

The alternative procedure is to allow migration to be determined on the basis of supply and demand in the various regions and educational categories. Equation 11 specifies the desired immigration level as the

$$(11) \qquad IMLABD_L = LEDDEM_L - LEDSUP_L$$

where

$$IMLABD_L \leq IMLABR_L$$

difference between labor/education demand and labor/education supply. It is also noted in that equation that it is possible on a regional and/or education level basis to set upper boundaries on either labor immigration or emigration (IMLABR).

After desired migration flows are determined for all regions and educational categories according to either equation 10 or equation 11, the next step is to sum the desired labor exports and desired imports for each educational category across all regions represented in WIM II. Equation 12 sums the world immigration demand by level of education (MLABW).

$$(12) \qquad MLABW_L = \sum_{R} IMLABD_L \quad \text{if } IMLABD_L > 0$$

That is, if the demand for labor migration is positive, representing

demand for inward migration (Immigration) the values are summed. Equation 14 then represents the actual world movement of labor in each educational category (LABW) as the minimum of the desired world total immigration and

(14) $LABW_L = \text{Minimum } (MLABW_L, XLABW_L)$

emigration.

It is obviously possible for either the world total of desired immigration or the world total of desired emigration to be larger. Equations 15 and 16 compute actual labor immigration and emigration respectively, allocating either available labor or desired labor among importing

(15) $IMLAB_L = IMLABD_L * LABW_L/MLABW_L \quad \text{if } IMLABD_L > 0$

(16) $IMLAB_L = IMLABD_L * LABW_L/XLABW_L \quad \text{if } IMLABD_L < 0$

and exporting regions.

At this point we have computed labor/education demand, supply, and migration for each educational category and for each region. The next three indicators provide us essential information about the labor supply in each region. Equation 17 computes the actual total labor force (LAB).

(17) $LAB = \sum_{L}^{L} (LEDSUP_L + IMLAB_L)$

That figure, of course, is the sum across educational categories of the labor/education supply (LEDSUP) plus migration (IMLAB). Note that when migration is negative, representing outward migration, this equation still holds.

Equation 18 represents unemployment in the economies for each country or region. It is equal to the labor/education supply plus the migration

$$(18) \qquad UNEMP = \sum_{L}^{L} (LEDSUP_L + IMLAB_L - LEDDEM_L)$$

of labor minus the labor/education demand. Finally, equation 19 tells us whether there are any labor shortages in the economy, these being computed as labor/education demand minus supply minus migration.

$$(19) \qquad LABSHO = \sum_{L}^{L} (LEDDEM_L - LEDSUP_L - IMLAB_L)$$

Please note that it is possible to have both unemployment and labor shortages in the same education or training category representing structural difficulties in matching demand and supply across categories for a given country or region. It is quite possible, for instance, that an economy with inadequate funds for educational expenditures will fail to educate sufficient numbers of people at various levels, will have a labor shortage of educated individuals, and at the same time will have significant unemployment of uneducated or lowly educated individuals.

This has been a fairly comprehensive discussion of the labor/education model. We can turn now to the scenarios which we have already analyzed with it.

4. Use of the Model in Policy Analysis

To test the education/labor submodel as a part of the total World Model, five scenarios were developed and analyzed focusing on the Mideast

and North Africa region of The World Model. This region was selected for analysis because of the possibility for labor and capital exchanges, for instance between Egypt and Saudi Arabia. Egypt has a large, underemployed and quite well educated (by LDC standards) labor force, but a great capital shortage. Saudi Arabia has a huge capital surplus, but a very small and underskilled labor force. This region thus offers an interesting test bed for analysis of educational programs, labor migration policies, and the linkage of these to economic growth. The subregions examined are Egypt, Saudi Arabia, the Gulf States, Iraq-Libya, and Syria-Jordan.

Scenario 0: The reference scenario. This scenario serves as a reference or base case in which no migration of labor among countries or regions was allowed and in which no special educational programs are developed.

Scenario 1: Free mobility of labor. In this scenario labor migration among countries, of laborers in all educational categories, is completely unrestricted. It is governed only by forces of supply and demand.

Scenario 2: Restrictions on mobility by labor importers. While allowing migration, this scenario restricts the absolute level and the categories of workers accepted so as to represent inevitable political and social decisions about the acceptability of immigrants.

Scenario 3: Restrictions on mobility by labor exporters. Whereas labor importers may hesitate to allow free immigration of the uneducated

and unskilled, labor exporters may wish compensation for the emigration of the educated. This scenario represents such compensation to the educational and training programs of exporting countries.

Scenario 4: Capital investment and labor exchange. This scenario goes beyond scenario 3 by expanding the level of compensation to include capital investment by the labor importers in the economies of labor exporters.

Scenario 3 is really two scenarios: Scenario 3-a in which labor exporting countries restrict emigration and Scenario 3-b in which there are no restrictions but compensatory payments are made. It is most likely that labor exporting countries would wish to restrict the outward movement of the more highly educated segments of the labor force. Thus Scenario 3-a placed great restrictions on the outward migration of workers with a high school or university education (corresponding to skilled or professional labor force). Among the countries and subregions examined here only Egypt was faced with significant outflows of educated labor. Saudi Arabia, the Gulf States and Iraq-Libya were all importers of labor of all types. Syria-Jordan proved to be an importer of more educated labor and an exporter of less educated labor. Thus, in Scenario 3-a we examine the impact of educated labor export restrictions by Egypt only. Scenario 3-b posed no restrictions on the outward migration of labor but required a compensation by labor recipient countries to labor exporting countries for the cost of the education of exported labor. In Scenario 3-b we examine the feasibility of compensating Syria-

Jordan sufficiently to increase the level of labor training and allow that subregion to become a net exporter of educated labor.

In reviewing the results of our scenario analysis we shall proceed region by region.

4A. Conclusions for Egypt

Egypt is one of the countries within the Arab Region with unemployed labor. Obviously the surplus consists primarily of individuals with little or no education or skills. However, were there to be free migration of labor within the Arab Region, Egypt would almost certainly provide individuals at relatively high levels of training and education to other regions as well as individuals with lesser levels of education.

Figure 6 shows the development projected by the model for Egyptian Gross National Product in all six of the scenarios developed for this proposal. If there were to be no migration, Egyptian GNP is shown to grow to 32.4 billion dollars (constant 1963 $) in 2025. At the other extreme, in Scenario 4 with full compensation for the cost of educated labor sent abroad in the form of capital investment, Egyptian GNP would grow to 49.3 billion dollars by 2025; this is an increase over the reference scenario without immigration of nearly 50%, and obviously could be of critical importance to Egypt. The other scenarios produced economic growth patterns which fall between these two extremes. For instance, in the case of free immigration, but without educational cost compensation, Egyptian GNP grows to 37.4 billion dollars in the year 2025.

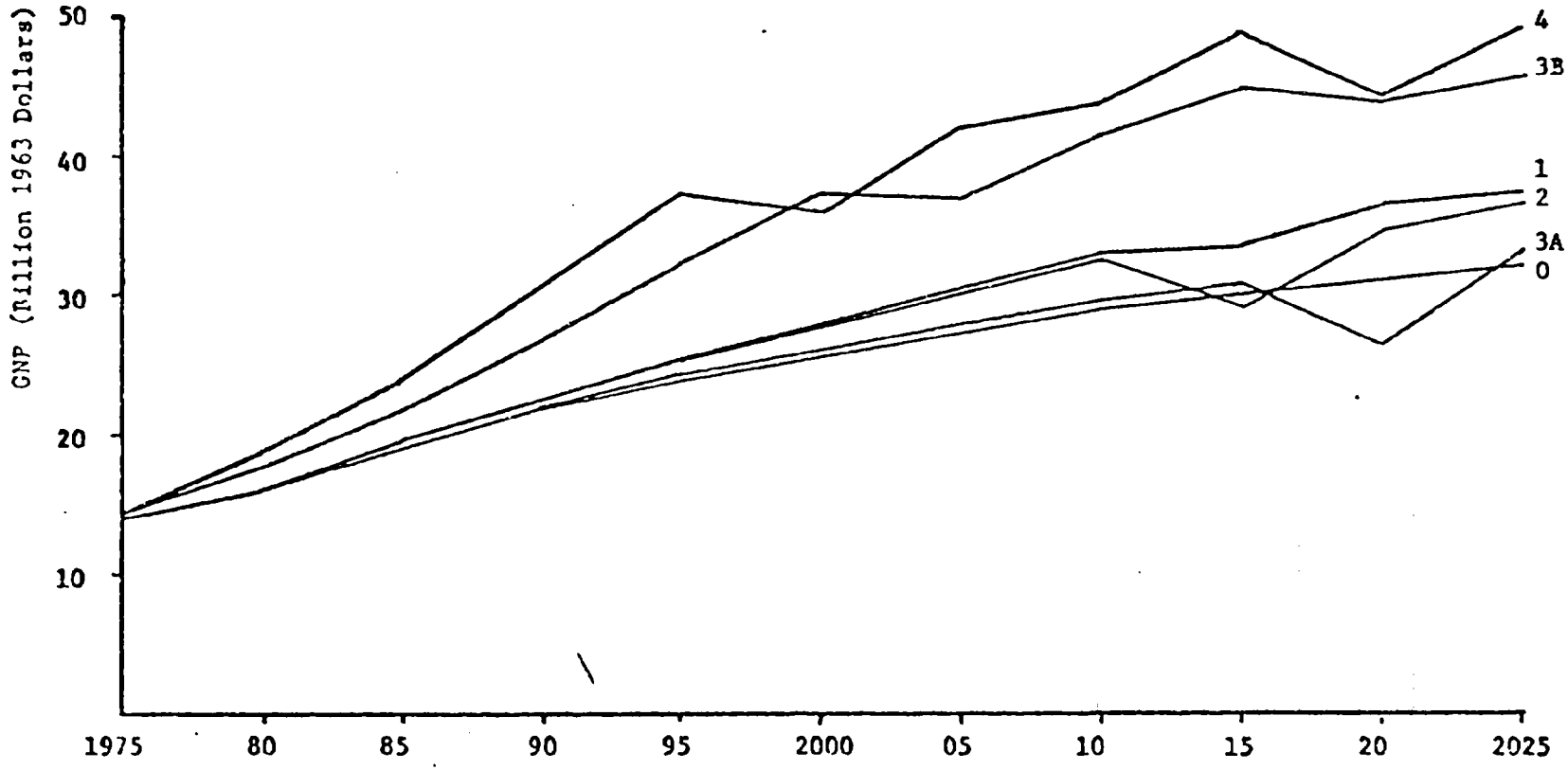


Figure 6: EGYPTIAN GNP

The difference between this level and the level of the reference scenario can be accounted for primarily by the repatriated earnings of Egyptian citizens abroad and the contribution to foreign exchange holdings which those repatriations would make.

The pattern of economic growth in Scenario 2 shows that restriction on the import of unskilled or semi-skilled workers by Saudi Arabia, the Gulf States and Iraq-Libya would have an adverse effect on Egypt, but the situation would still be improved vis-a-viz the reference scenario.

The pattern for Scenario 3-a shows that restrictions by Egypt on the export of workers with education would be self-defeating in that it would return Egyptian growth pattern to one similar to the reference scenario. Interestingly also, such restrictions would have very little effect on the labor importing countries of the Arab Region, because very adequate alternative supplies of educated labor exist in the Western developed regions (again illustrating the importance of undertaking such an anlysis in the global context). As a strategy for obtaining compensation for the educational costs of laborers who emigrate, threatened or actual restrictions on emigration appear fruitless.

Turning to scenarios in which compensation for educational costs is freely given, note that the difference between Scenario 3-b and Scenario 4 for Egypt is not as great as might be expected. The reason for this proves in more detailed analysis to be that the most important contribution to Egyptian growth comes in the form of foreign exchange earnings by workers abroad or foreign exchange as a result of education compensation

programs. Additional or more limited contribution to growth is made when those education compensation programs are marked specifically for capital investment. The major limitation to Egyptian growth in all scenarios proves to be chronic deficits in the balance of payments and limited ability to import machinery or other goods from the outside world.

Figure 7 shows another consequence of the various scenarios analyzed here. Specifically, it projects the level of unemployment in the Egyptian economy. In the reference scenario that unemployment goes from nearly 3 million people in 1975 to 12 million in the year 2025. In the case of free international labor migration, Scenario 1, Egyptian unemployment remains at a level between 2 and 3 million people. Clearly, this is a benefit of regional labor flows with an importance as great or greater than the differential economic growth patterns in the two scenarios.

In Scenario 2, with restrictions on the import of less educated labor by the primary labor importing countries of the region, Egyptian unemployment grows near the end of the period to 5.5 million people. In fact, the model projects a fairly significant increase in the unemployment level near the end of the period in all scenarios as a result of relative stagnation in Egyptian economy and continuing increases in the labor force (resulting from changes in the population and changes in the labor participation rate).

Scenario 3-a shows that restrictions by Egypt on the exports of labor cause unemployment levels to approach those of the reference scenario. Scenarios 3 and 4 produce unemployment patterns much more

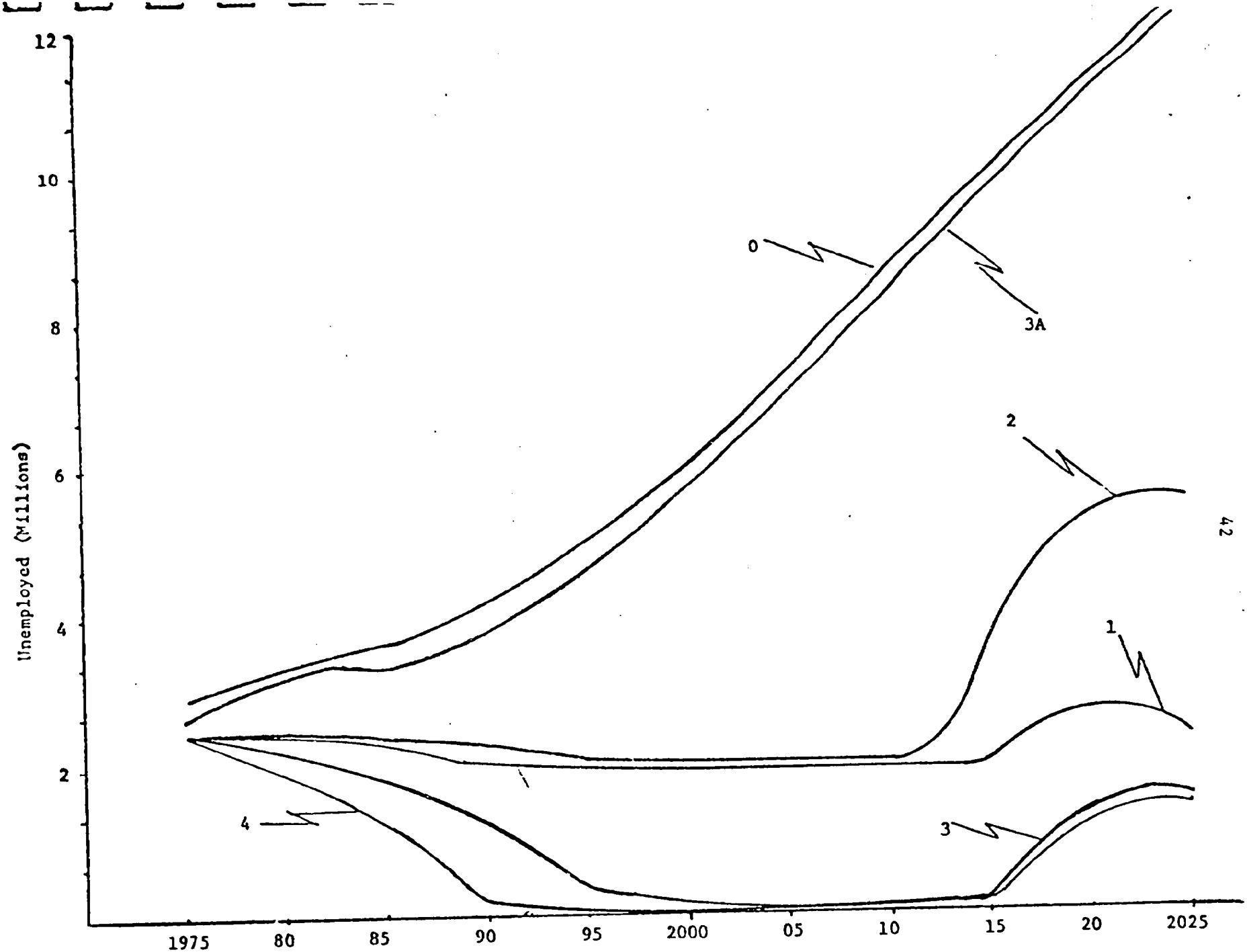


Figure 7: Egyptian Unemployment

favorable to Egypt as the result of the higher economic growth of the region following the compensatory payments for labor costs by labor importing regions.

Figure 8 shows the pattern of labor migration from Egypt in Scenario 1, the free immigration scenario. This pattern is illustrative of all the scenarios in which labor flows are unrestricted. The bulk of the labor flow proves to be in the category of individuals with primary level education only, corresponding to semi-skilled labor. Non-zero but lesser levels of emigration can be seen in the categories of uneducated labor and labor force with secondary and university educational training. Figure 9 illustrates for the same scenario the pattern of labor supply within the Egyptian economy. The bulk of the labor initially is in the uneducated category but over time increasing proportions of the labor force receive some education, especially at the primary level. After the turn of the century the number of workers in the labor force with a primary education surpasses those without any education and continues to grow.

4B. Conclusions for Saudi Arabia

Figure 10 shows the economic development of Saudi Arabia in the five scenarios (there is no major distinction between Scenarios 1 and 3-a as far as labor importing countries are concerned. In the reference case, without any immigration, the Saudi GNP grows from 24 billion dollars in 1975 to 179 billion in 2025. In Scenario 1 with free flow of labor

IMLAB MOED EGYPT	IMLAR PRIM EGYPT	IMLAR SECO EGYPT	IMLAR UNIV EGYPT
-0.00214	-0.00214	-0.00218	-0.00218
-5.87326	-5.87326	-5.87326	-5.87326
N	P	S	U

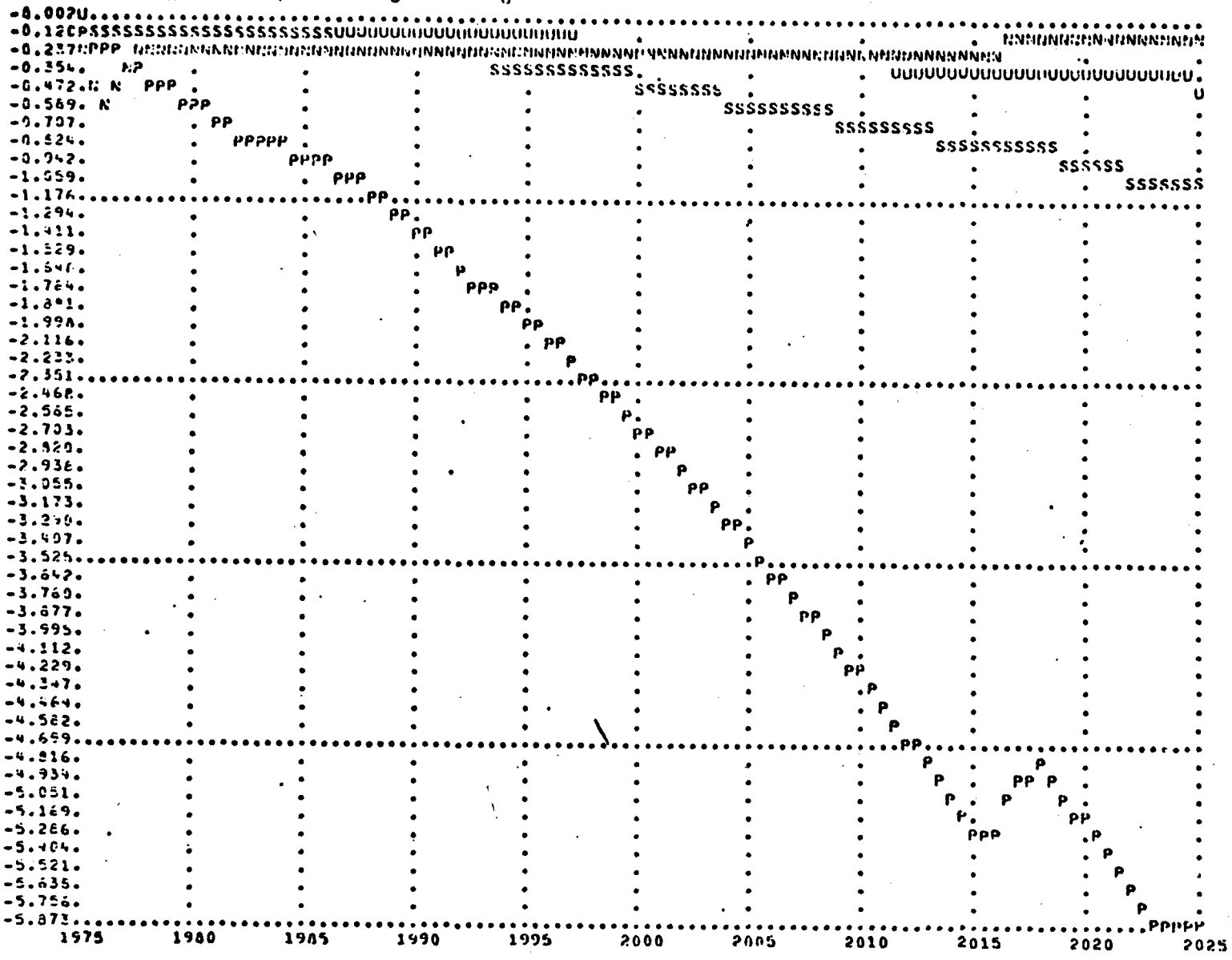


Figure 8. Labor Migration in Egypt: *Scenario 1*

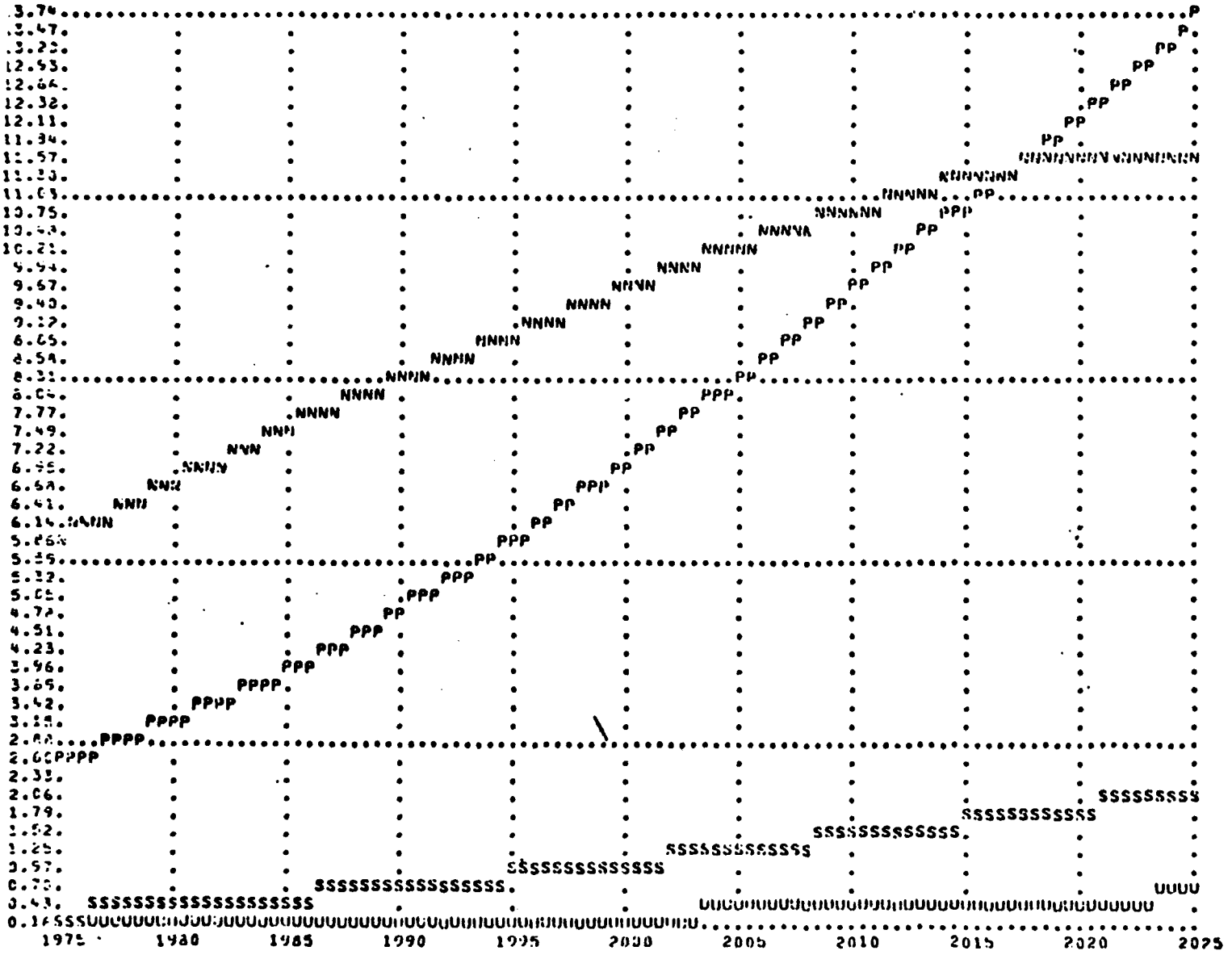
LEDSUP MOED EGYPT 13.7422 0.1587 N

LEDSUP PHIS EGYPT 13.7422 0.1587 P

LEDSUP SECO EGYPT 13.7422 0.1587 S

LEDSUP UNIV EGYPT 13.7422 0.1587 U

Figure 9 Labor/Education Supply in Egypt: *Scenario 1*



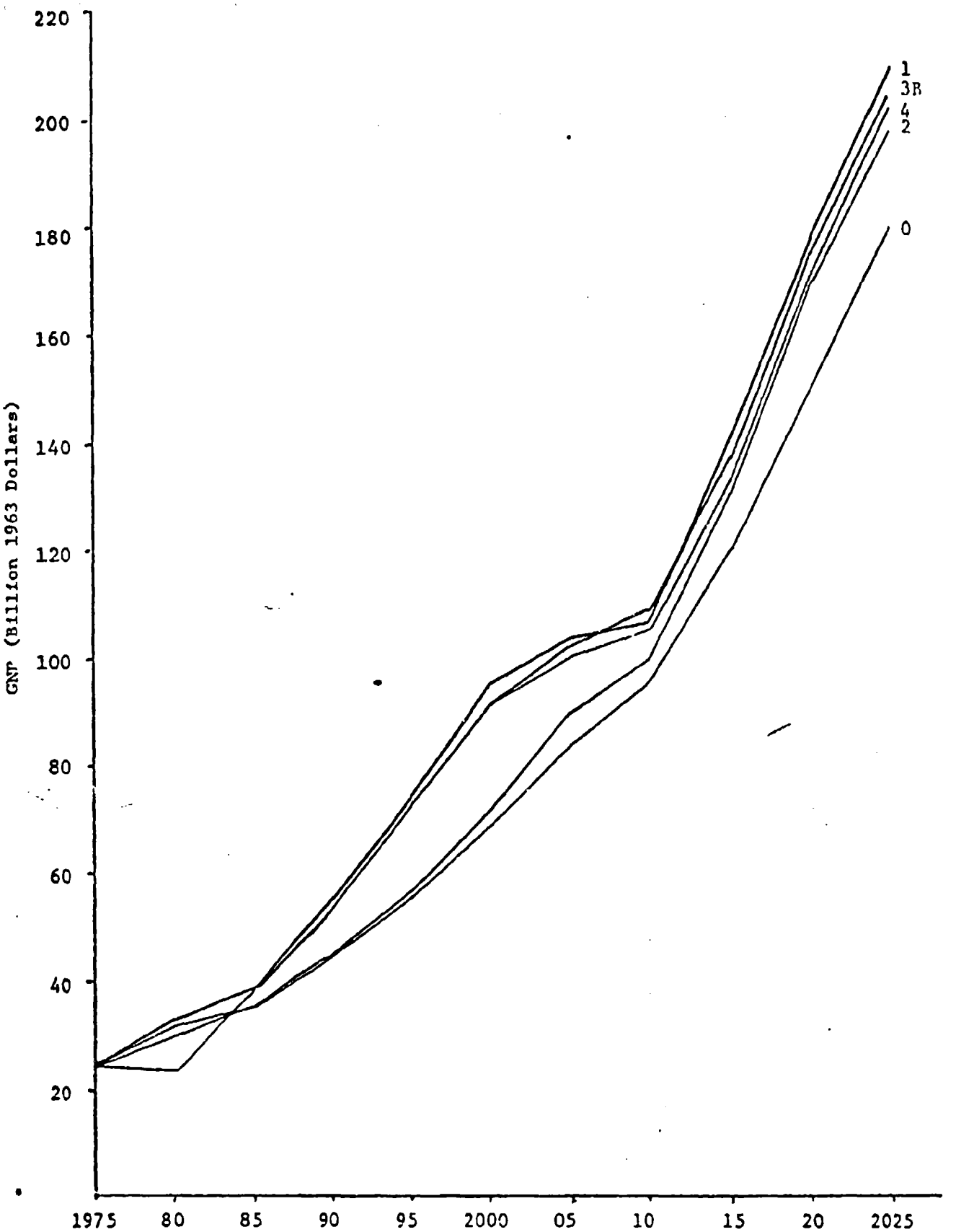


Figure 10 SAUDI GNP

internationally, and without any compensatory payments by Saudi Arabia to the regions from which the labor is coming, the GNP reaches 209 billion dollars in 2025, a value approximately 17% higher than in the reference scenario. In Scenario 2, in which Saudi Arabia restricts the immigration of uneducated labor and those with only a primary school education to 10% of its own population, economic growth still reaches a level of 17 billion dollars higher than in the reference scenario by 2025. In the remaining scenarios, again with free flow of labor but with compensatory payments by Saudi Arabia, the GNP reaches levels of 200 billion dollars or more in each case.

Figure 11 illustrates why Saudi Arabia might have some desire to restrict the import of less educated labor. That figure shows the level of immigration in each labor category in Scenario 1, the unrestricted immigration scenario. Although fairly significant numbers of people with university degrees and with secondary education are imported, particularly from 1990 onward, large numbers with primary education only or without education are also attracted to Saudi Arabia. The figure shows that those without education would begin to decrease naturally near the end of the period as a result of the level of development within Saudi Arabia and the increasing shift towards employment of more skilled individuals.

Figure 12 shows the pattern of immigration in Saudi Arabia given the restriction on imports of uneducated and primary educated to only 10% of the total population. In this case we see the large number of skilled and professional workers who continue to be imported.

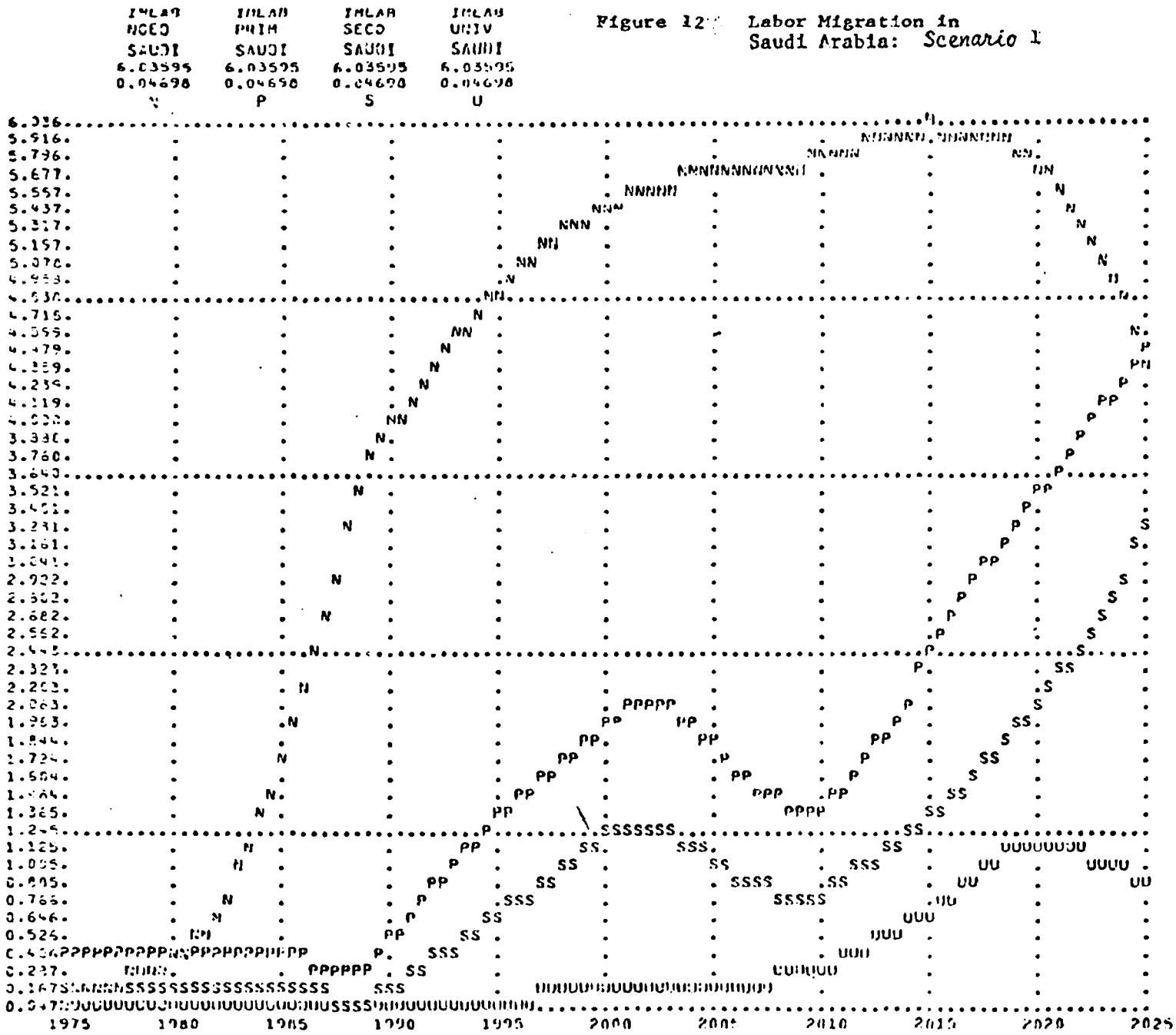


Figure 12: Labor Migration in Saudi Arabia: *Scenario 1*

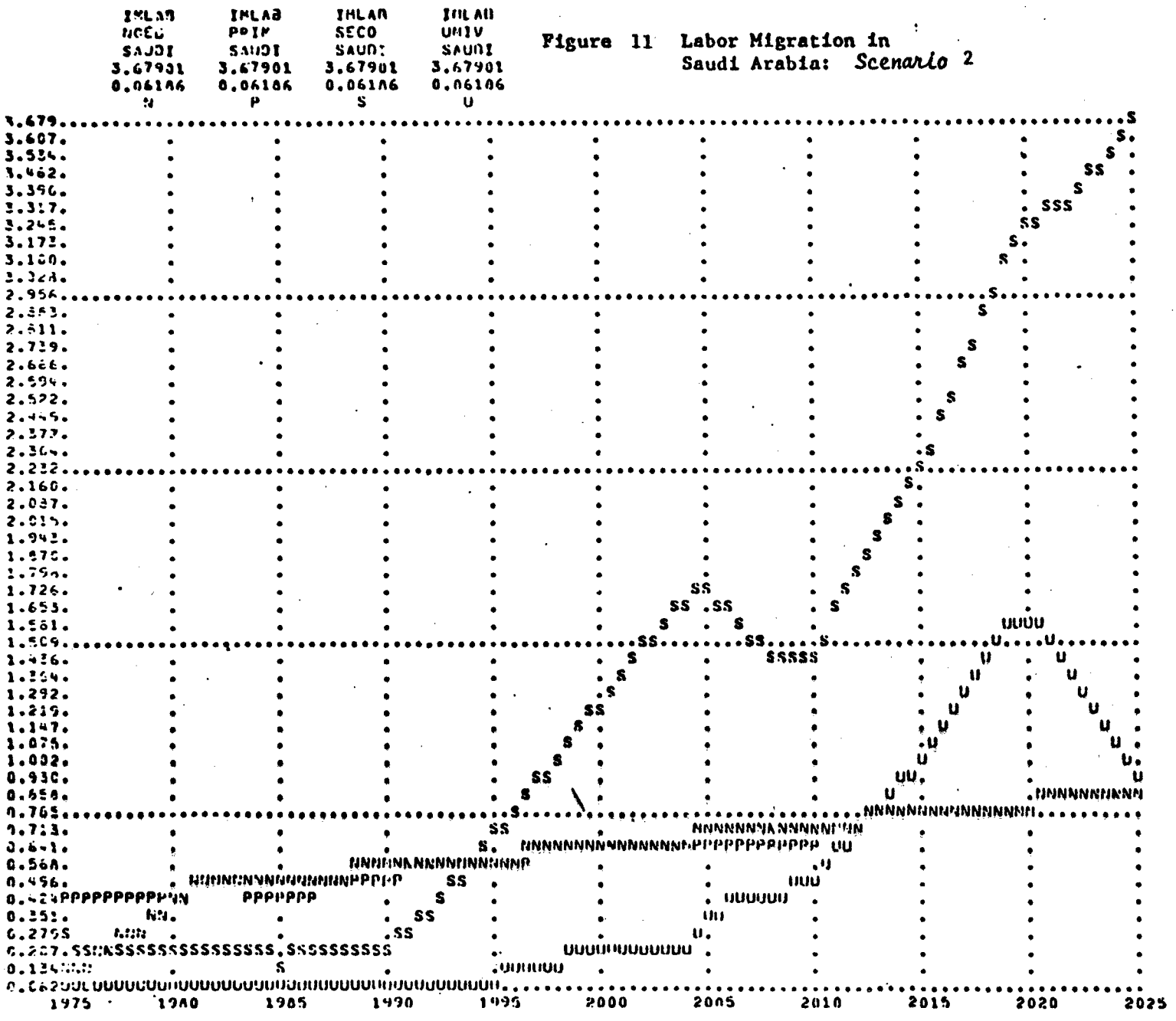


Figure 11 Labor Migration in Saudi Arabia: *Scenario 2*

Figure 13 is also of interest because it shows the labor supply within Saudi Arabia. It shows first the relatively rapid decrease in the number of labor force members who fall into the illiterate or uneducated category. It shows the rapid increase in those with a primary education only, but also indicates that the demand for such workers and thus the supply would decrease as economic development continued. The supply of individuals with secondary and university education continues to increase over the entire 50 years.

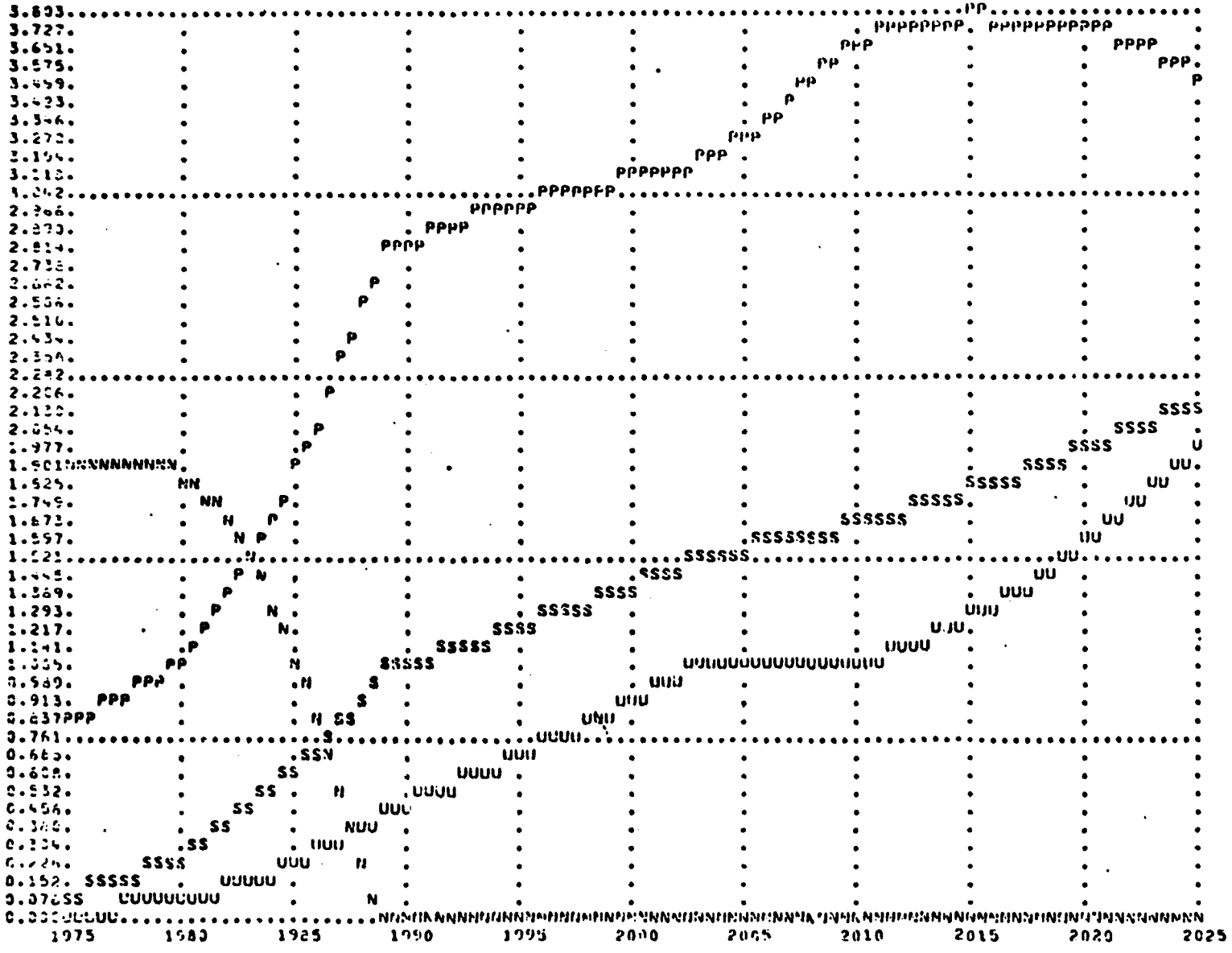
In sum, Saudi Arabian economic growth is definitely furthered by the importation of foreign labor with or without compensatory payments to cover the cost of their education in their home lands. It is also clear, however, that completely free migration would lead to a considerable influx of labor with little or no educational background, and the desirability of such labor importation would have to be balanced against the possible economic benefits.

4C. Conclusions for the Gulf States

Figure 14 portrays the economic growth patterns of the Gulf States in the five principal scenarios. In the reference scenario without international migration of labor, the GNP of the Gulf States increases from approximately 20 billion dollars in 1975 to 163 billion in 2025. With free migration of labor the level reached in 2025 is 211 billion dollars, nearly 30% above the level without labor migration. All in all, the pattern of economic development, of labor immigration and of domestic

LEDSUP NOED SAUDI	LEDSUP PRIM SAUDI	LEDSUP SECO SAUDI	LEDSUP UNIV SAUDI
3.80283	3.80283	3.80283	3.80283
0.00000	0.00000	0.00000	0.00000
N	P	S	U

Figure 13 Labor/Education Supply in Saudi Arabia: *Scenario 1*



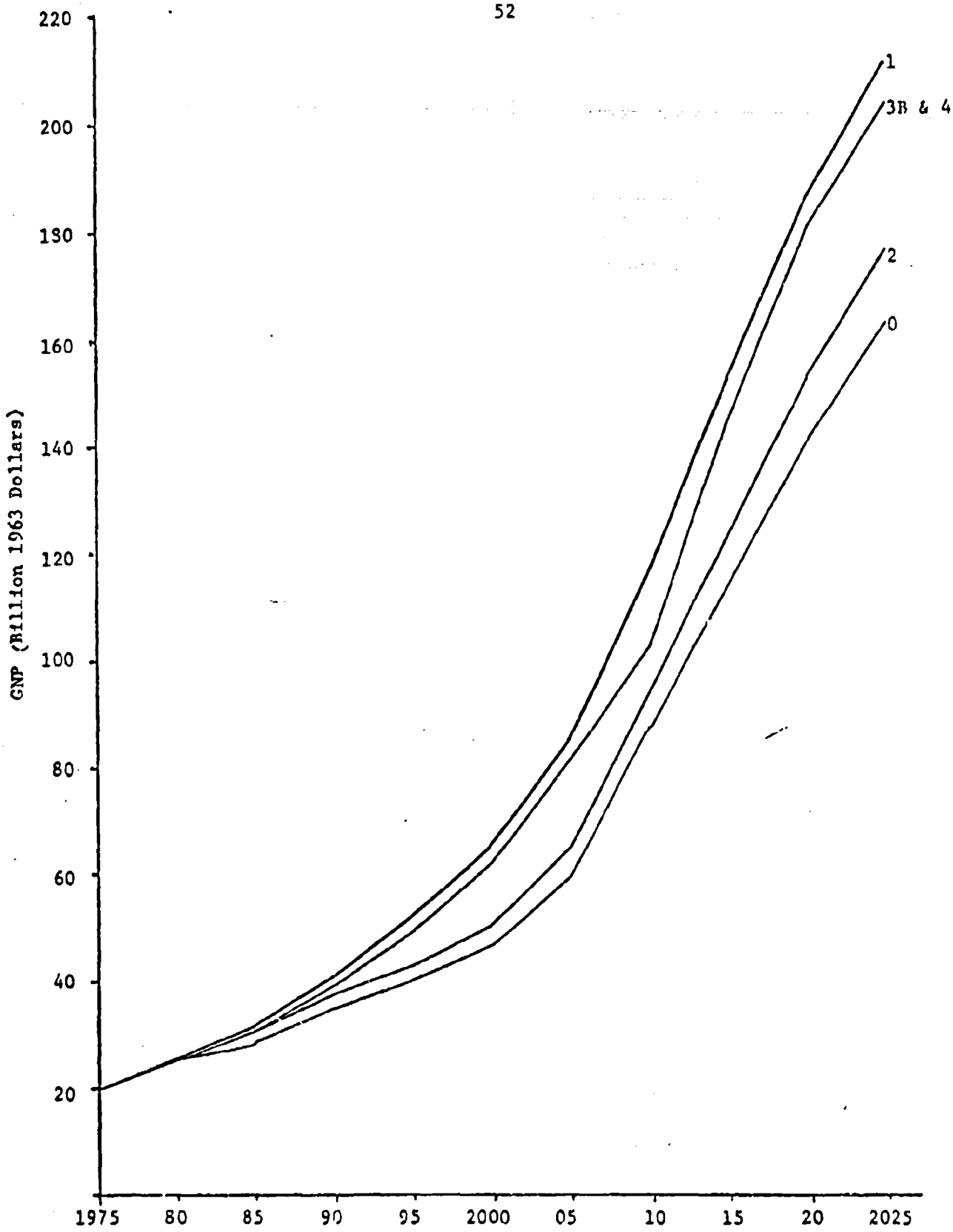


Figure 14 . GULF GNP

labor supply, is similar in the Gulf States to that already discussed for Saudi Arabia.

4D. Conclusions for Iraq-Libya

Figure 15 shows the GNP's of these two countries combined for each of the five principal scenarios investigated in this proposal. Again, the pattern is much like that for the Saudi Arabia and the Gulf. With the importation of labor in Scenario 1, the GNP of Iraq-Libya reaches 162 billion dollars in 2025 compared with 149 billion dollars in the reference scenario without immigration. One difference between the pattern of Iraq-Libya and either Saudi Arabia or the Gulf States, however, appears in Scenario 2 with the restriction of immigration for uneducated or lowly educated labor. In this case the GNP of Iraq-Libya actually reaches a level of 168 billion dollars by 2025, slightly higher than with free immigration.

The reason for this seemingly counterintuitive result is revealed by more detailed analysis of the economic and demographic data. Note that in Figure 15 economic growth in Iraq-Libya with restrictions on the importation of less educated workers is less rapid through the end of the century and into the 21st century than in the scenario with free importation of labor. This has a number of different consequences. The more rapid growth of Scenario 1 results for instance in more rapid

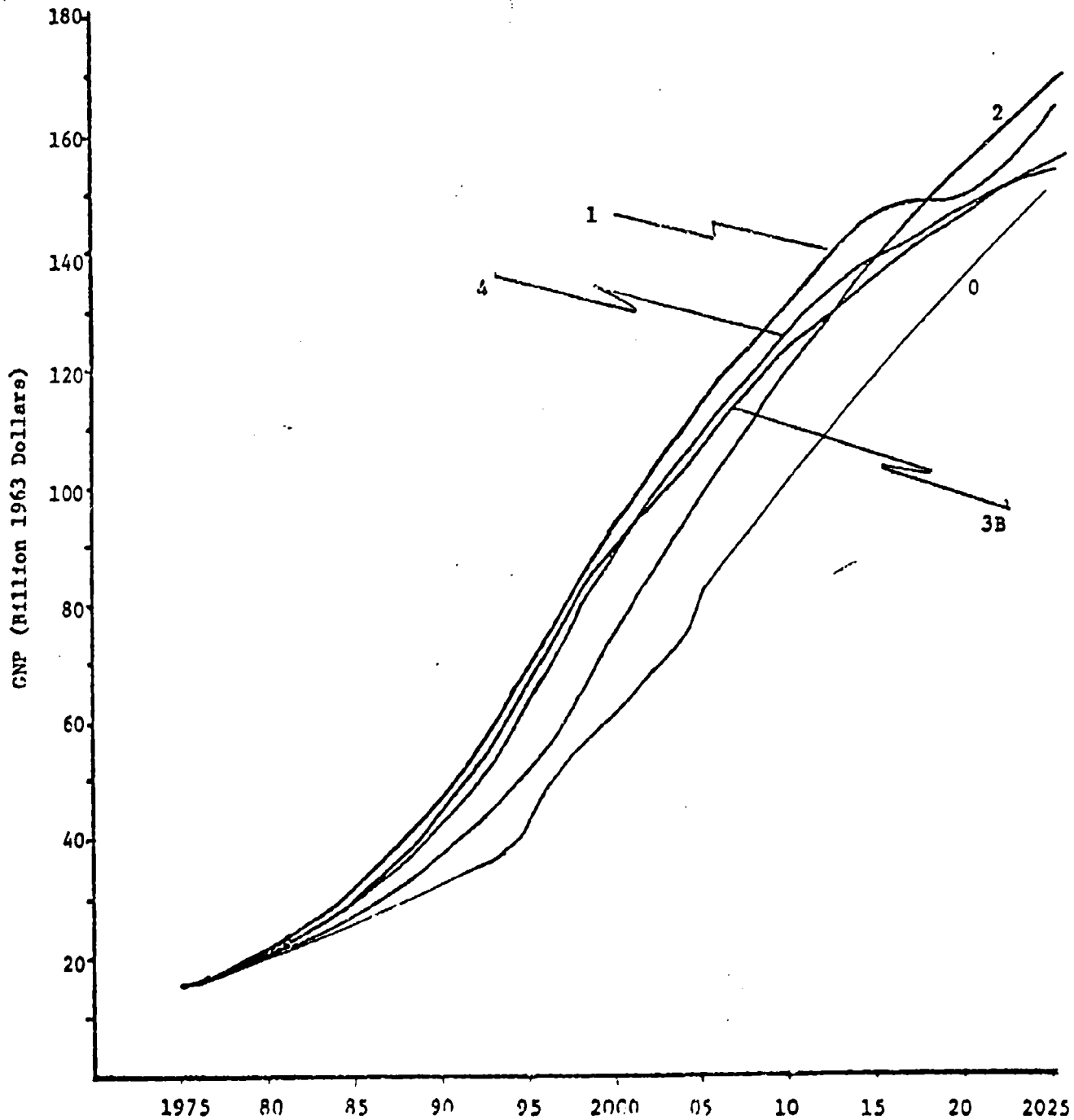


Figure 15 IRAQ-LIBYA GNP

reductions in fertility rates than in Scenario 2. The long term consequence of this is that the domestic labor force is lower by the end of the period in Scenario 1 than in Scenario 2. This results in greater labor shortages in Scenario 1 and in fact slower growth near the end of the period. Here we see an illustration of the necessity for examining a relatively long period of time and using a dynamic model in order to reveal the full consequences of any policy or social development.

4E. Conclusions for Syria-Jordan

Figure 16 traces the pattern of economic development in Syria-Jordan in each of our five major scenarios. We can see that in the reference case without migration of labor, the GNP for Syria-Jordan goes from 4 billion dollars in 1975 to 15 billion dollars in 2025. Interestingly, in the case of free labor immigration the economy of Syria-Jordan actually does less well. Again, the reason for this surprising result lies deeper in the data. Syria-Jordan is a region with a surplus of uneducated labor and relative shortages of skilled and professional labor. Thus, the free movement of labor causes Syria-Jordan to import a greater amount of labor than it exports. In large part, this is because of the relatively poor international market for uneducated labor. The more educated workers who migrate into Syria-Jordan do of course contribute to the economy of that region. They also, however, repatriate a portion of their earnings back to their home countries. In the process of doing this they actually weaken the balance of payments situation of Syria-Jordan. Much as in the case of Egypt, the balance of payments implications

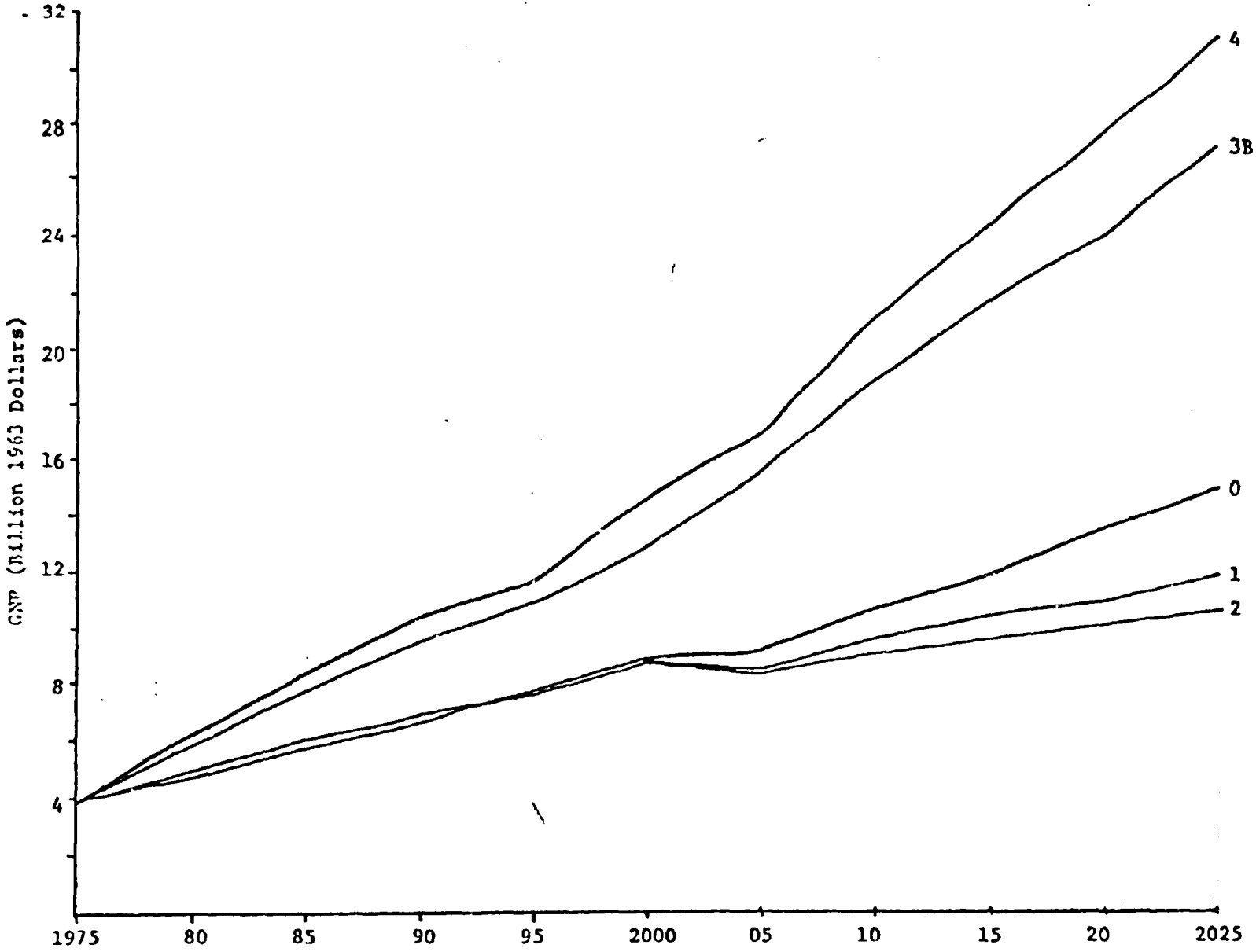


Figure 16 Syria-Jordan GNP

of the labor migration prove more important than the actual economic contributions of the labor.

Scenarios 3-b and 4, however, completely change the situation for Syria-Jordan. The intention of those scenarios was, of course, to compensate labor exporting regions for the cost of educating the exported labor. We have seen how that worked in the case of Egypt. Syria-Jordan, however, is not strictly a labor exporting region but instead a labor surplus region with a surplus of less educated labor and a deficit of trained and educated labor. In the preparation of Scenarios 3-b and 4 a level of financial transfers to Syria-Jordan was calculated so that Syria-Jordan could (i) increase its level of educational expenditures, (ii) move much of the labor force from the surplus uneducated category to the deficit educated categories, (iii) eliminate its import of educated labor, and (iv) actually become a region with educated labor exports.

The results of the transfer, however, which began at a level of 150 million dollars in 1975 and increased to 700 million dollars annually in 2025 were somewhat different from that which was anticipated. The transfer and increased emphasis on educational expenditures within Syria-Jordan did have the expected result of eliminating the surplus of uneducated labor. Figure 17 shows the level of unemployment in Syria-Jordan under the various scenarios. Instead of unemployment increasing to over 5 million people in 2025 without the international transfers, we can see that unemployment drops to a very low level with the transfers. Syria-Jordan does not, however, become an exporter of educated labor. Instead, the transfers

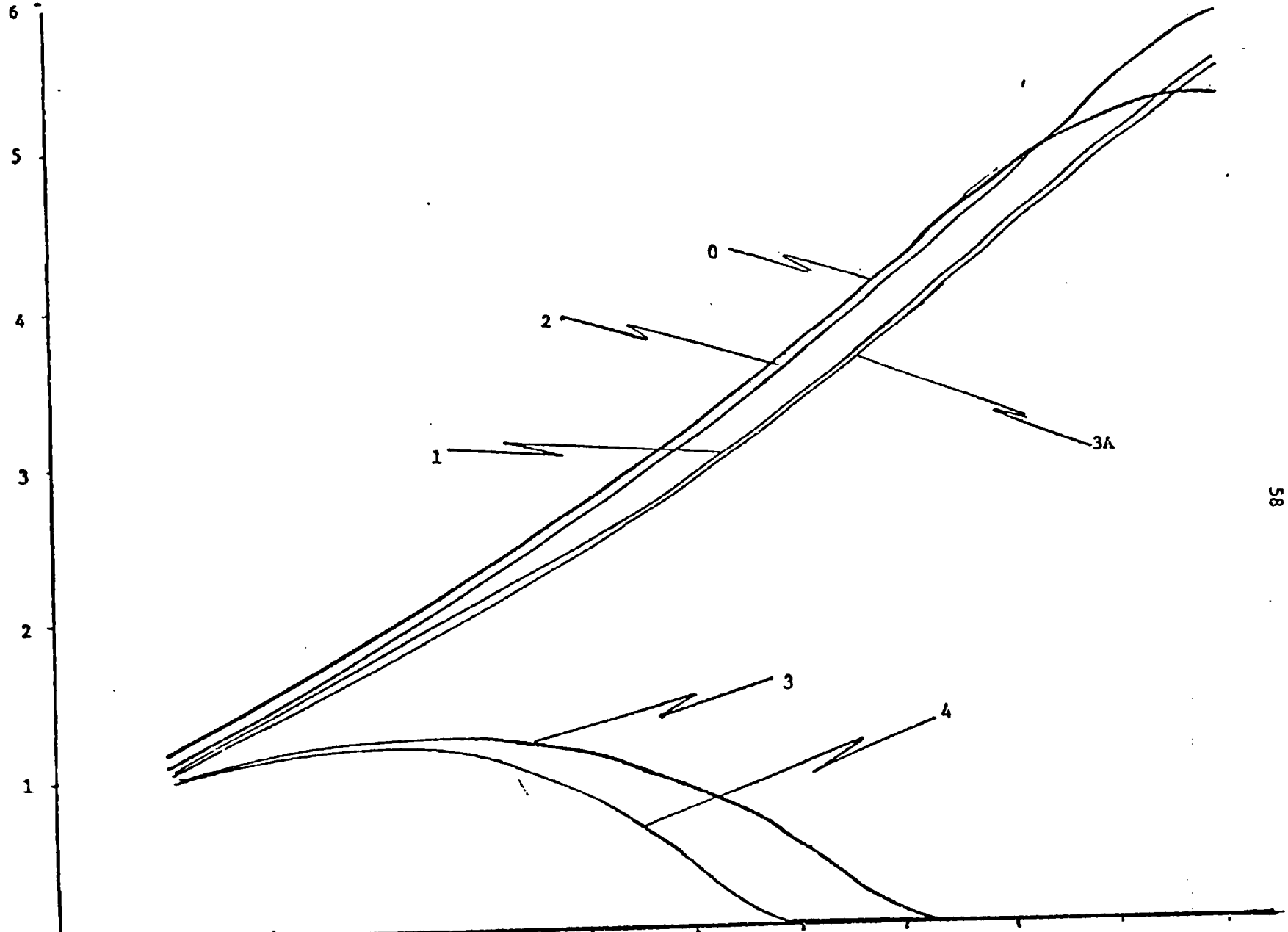


Figure 17 Syria-Jordan Unemployment

contribute significant amounts of foreign exchange, allow considerably more rapid economic growth, and very considerably increase the domestic demand for labor. Thus, the overall result of the international transfers is to further increase the importation of labor by Syria-Jordan.

Again, we have found a result which without the model was unanticipated, and which can be explained or traced through the dynamics of the model logic. Presumably a lower level of international transfers to Syria-Jordan, combined with continuing emphasis upon higher educational expenditures, would result in an economy without labor surpluses and with a reduced need to import labor, perhaps even with an exportable educated labor surplus. Experimentation with the model could produce information about that level of financial transfers.

5. Concluding Observations

We have seen through these scenarios the potential use of the World Model and the new education/labor submodel for analysis of Arab Region development plans. We have seen for instance that economic growth by 2025 can vary as much as 20 or 30% in different countries depending upon regional policies concerning the flow of labor. This, of course, should not be construed to suggest that policies concerning education and labor migration in themselves are sufficient to resolve the currently great inequalities of income within the region. Figure 18 shows the gross national product per capita for each of the five subregions examined here in Scenario 4, that which most contributes to the economic development

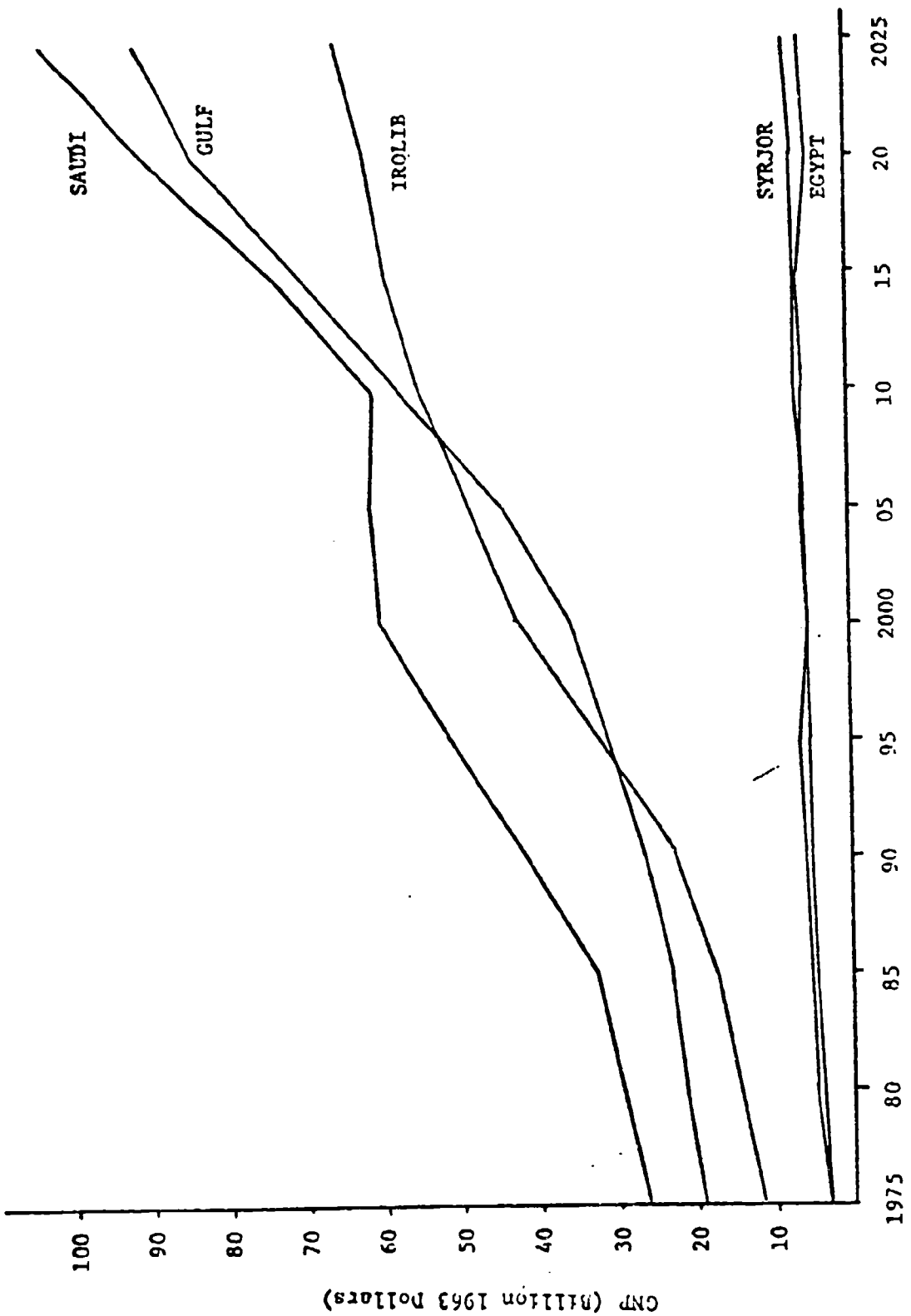


Figure 18 : GNP Per Capita in Scenario 4

of the poor regions in the area. Whereas the gap between the wealthiest and the poorest was approximately a factor of 9 in 1975 it increases to a factor of 18 in the year 2025.

Although elimination or reduction of income inequality in the Arab Region or anywhere else in the world is by no means the only objective of national and regional development programs, it must be one objective. Clearly, the kinds of programs analyzed here can contribute to the prevention of even more rapid growth in regional inequality. This analysis, however, suggests that aspects of regional cooperation and development other than education must be examined if we are to actually reduce income inequality.

Appendix I

A

Economic Sectors:		I	II	III	IV	V	VI	VII
Israel*								
Educ. Level	1	19875	535	8310	8460	4070	4395	17645
		20.6%	12.6%	5.0%	14.1%	4.8%	7.5%	7.3%
	2	45890	5255	100220	38335	42475	31155	100000
		47.6%	52.9%	60.9%	63.9%	50.5%	53.4%	41.3%
	3	28165	1080	48060	10430	30855	19630	87095
		29.0%	25.4%	29.1%	17.4%	36.7%	33.6%	35.9%
	4	2495	385	8010	2745	6675	3200	37455
		2.6%	9.1%	4.8%	4.6%	7.9%	5.5%	15.5%
U.S.S.R.	1	15471	2948	----	848	736	693	1877
		39.2%	12.7%	----	12.4%	15.1%	12.0%	12.0%
	2	14178	8451	----	2769	1340	2079	2981
		35.9%	36.4%	----	40.5%	27.4%	36.1%	19.2%
	3	9624	11353	----	3015	2724	2892	8650
		24.4%	48.9%	----	44.1%	55.7%	50.2%	55.5%
	4	134	465	----	205	84	74	2194
		.3%	2.0%	----	2.9%	1.7%	1.3%	14.0%
Poland*	1	----	----	----	----	----	----	----
	2	330561	296174	1983213	488215	484966	725946	479835
		84.2%	77.9%	73.6%	69.7%	60.5%	74.8%	40.1%
	3	53533	78334	658585	176487	297766	232791	540473
		13.6%	20.6%	24.4%	25.2%	37.1%	23.9%	45.2%
	4	8701	5594	53100	35258	18955	12035	176743
		2.2%	1.5%	2.0%	5.1%	2.4%	1.2%	14.7%
Hungary*	1	----	----	----	----	----	----	----
	2	1832886	143196	1008751	263886	252208	302310	354055
		97.8%	91.0%	85.3%	87.0%	77.2%	83.9%	65.0%
	3	29477	11196	139545	27257	60305	49211	107424
		1.6%	7.1%	11.8%	9.0%	18.5%	13.6%	19.7%
	4	10367	2905	33820	12121	13931	8866	82052
		.5%	1.8%	2.9%	3.0%	4.3%	2.5%	15.1%

Source: OECD, Statistics of the Occupational and Education Structure of the Labor Force in 53 Countries, Paris, 1969.

Economic Sectors:		I	II	III	IV	V	VI	VII
Uraguay								
Educ. Level	1	350	4	99	61	50	43	262
		19.3%	16.6%	4.7%	12.4%	3.8%	5.4%	7.7%
	2	1369	18	1556	385	804	571	2112
		75.3%	75.0%	73.6%	78.7%	60.9%	72.0%	62.1%
	3	75	2	401	35	381	151	574
		4.1%	8.3%	18.9%	7.2%	28.8%	19.0%	16.8%
	4	24	----	56	8	84	27	453
		1.3%	----	2.6%	1.6%	6.4%	3.4%	13.3%
Ecuador*	1	343351	544	31702	8401	9160	2627	34643
		42.8%	15.3%	15.1%	17.5%	9.4%	5.5%	14.7%
	2	447934	2592	151577	35612	61621	34558	125387
		55.8%	73.0%	72.1%	74.1%	63.5%	72.5%	53.4%
	3	8272	292	21424	2367	21687	8994	52285
		1.0%	8.2%	10.2%	4.9%	22.3%	18.0%	22.2%
	4	2065	119	5471	1656	4629	1441	22179
		.2%	3.3%	2.6%	3.4%	4.7%	3.0%	9.4%
Panama*	1	62015	46	1265	599	1331	331	4268
		40.5%	12.7%	5.7%	6.4%	4.8%	3.3%	5.5%
	2	87563	241	12966	5908	13339	5637	41398
		57.2%	66.9%	58.7%	63.4%	48.5%	55.9%	53.7%
	3	3034	60	7194	2325	10884	3602	24662
		1.9%	16.6%	32.6%	24.9%	39.6%	35.7%	32.0%
	4	446	13	654	480	1928	501	6696
		.3%	3.6%	2.9%	5.2%	7.0%	4.9%	8.6%
Peru*	1	719272	10025	73099	10543	29904	4869	90339
		47.0%	15.0%	18.0%	10.0%	11.0%	5.0%	16.0%
	2	761731	45018	259278	76504	148276	68476	283786
		50.0%	69.0%	64.0%	76.0%	55.0%	68.0%	50.0%
	3	31388	8062	64101	11570	80340	24895	127681
		2.0%	12.0%	16.0%	11.0%	30.0%	25.0%	23.0%
	4	3092	2314	6902	2607	12166	1923	64498
		.2%	4.0%	2.0%	3.0%	4.0%	2.0%	11.0%

Economic Sectors:		I	II	III	IV	V	VI	VII
Argentina*								
Educ. Level	1	231200 17.0%	3825 10.0%	75555 4.0%	28285 7.0%	22540 3.0%	20465 3.0%	127240 6.0%
	2	1091550 81.0%	32630 85.0%	1605745 89.0%	363795 88.0%	753915 86.0%	538800 91.0%	1639355 74.0%
	3	9715 1.0%	1210 3.0%	75390 4.0%	11470 3.0%	64020 7.0%	22005 4.0%	248780 11.0%
	4	9920 1.0%	755 2.0%	45480 3.0%	9940 2.0%	41205 5.0%	11960 2.0%	204820 9.0%
Egypt*	1	3319090 80.3%	13566 65.0%	345079 49.0%	99760 64.0%	306521 49.0%	125149 43.0%	580684 40.0%
	2	795538 19.2%	5427 26.0%	317194 45.0%	52150 33.0%	276419 44.0%	137187 47.0%	526403 37.0%
	3	13144 .3%	1087 5.0%	29587 4.0%	2847 2.0%	31291 5.0%	24101 8.0%	216470 15.0%
	4	2626 .06%	704 3.0%	6452 1.0%	2089 1.0%	10046 2.0%	5598 2.0%	118537 8.0%
Syria*	1	353131 70.7%	2708 68.6%	48219 41.2%	29179 55.7%	29711 34.9%	13894 32.0%	66537 34.2%
	2	144140 28.8%	1220 30.9%	66666 56.9%	22861 43.6%	51460 60.5%	27395 63.2%	93759 48.2%
	3	1520 .3%	14 .4%	1846 1.5%	234 .4%	3080 3.6%	1804 4.2%	27734 14.3%
	4	152 .03%	5 .1%	238 .2%	80 .1%	720 1.0%	223 .5%	6416 3.3%
Zambia*	1	24356 95.7%	45265 84.2%	26551 85.0%	41893 94.0%	16704 68.4%	11763 79.0%	62093 80.9%
	2	275 1.1%	4123 7.6%	2015 6.4%	1271 2.8%	2933 12.0%	1606 10.8%	6468 8.4%
	3	712 2.8%	3716 6.9%	844 2.7%	1235 2.7%	4543 18.6%	1357 9.2%	5856 7.6%
	4	94 .3%	643 1.2%	147 .4%	168 .4%	235 1.0%	276 1.0%	2301 2.9%

Economic Sectors:		I	II	III	IV	V	VI	VII
Thailand								
Educ. Level	1	4066	5	152	19	303	22	180
		39.3%	17.2%	33.4%	27.9%	40.7%	12.1%	20.8%
	2	5802	21	272	43	378	130	541
		56.1%	72.4%	59.9%	63.2%	50.8%	71.8%	62.6%
	3	461	3	29	5	58	24	124
		4.4%	10.3%	6.4%	7.3%	7.8%	13.2%	14.3%
	4	14	----	1	1	5	2	32
		.1%	----	.2%	1.4%	.6%	1.1%	3.7%
Philippines*	1	1202038	6290	171402	20331	94080	16467	7916
		21.0%	18.5%	15.4%	8.1%	10.0%	5.0%	7.0%
	2	3881347	21012	655557	151855	491904	193270	509135
		69.0%	61.8%	58.9%	60.5%	55.0%	57.0%	45.0%
	3	477445	4624	227052	65511	214144	106392	223173
		8.5%	13.6%	20.4%	26.1%	24.0%	31.0%	20.0%
	4	56260	2074	60102	13805	98560	2487	331531
		1.0%	6.1%	5.4%	5.5%	11.0%	7.0%	29.0%
India	1	124588	391	16904	1698	5347	1968	14246
		95.0%	94.1%	84.5%	82.4%	69.8%	65.2%	72.7%
	2	6061	231	2374	213	1662	560	2649
		4.6%	4.4%	11.8%	10.3%	21.7%	18.5%	13.5%
	3	381	68	436	99	452	318	1509
		.2%	1.3%	2.1%	4.8%	5.9%	10.5%	7.7%
	4	113	11	193	49	193	173	1170
		.08%	.2%	.9%	2.3%	2.5%	5.7%	5.9%

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